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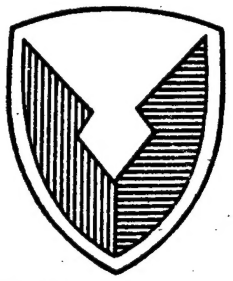

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CUSTOMER REPORT

PHASE 1 OF DEFENSE SPECIAL WEAPONS AGENCY TRANSPORT AND DISPERSION MODEL VALIDATION

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Phase I of the Defense Special Weapons Agency (DSWA) Transport and Dispersion Model Validation test was conducted in September 1996 at the U.S. Army Dugway Proving Ground Photo Pad 11 test site to acquire a puff ensemble database for validation of next generation puff dispersion models, specifically the Second Order Closure Integrated Puff (SCIPUFF®) model. The test consisted of a series of tracer (propylene) puff releases into the atmosphere at distances ranging from 200 to 1200 m upwind of photoionization detectors (PIDs). The PIDs sampled the puff as it passed through the detector line, providing tracer gas concentration measurements. A total of 32 trials were completed. Puff data from these trials have been consolidated into ensembles in the relative (puff-centered) frame of reference for use in validating the probabilistic prediction capabilities of SCIPUFF and other next generation models.

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FOREWORD

This report describes work accomplished under TECOM Project No. 8-ES-685-CPB-003 for the Defense Special Weapons Agency (DSWA). Phase I of the DSWA Transport and Dispersion Model Validation program was a tripartite effort with active participation by the British Chemical/Biological Defence (CBD) sector of the Defence Evaluation and Research Agency (DERA) at Porton Down, England; the Canadian Defence Research Establishment Suffield (DRES); and the West Desert Test Center (WDTC), U.S. Army Dugway Proving Ground (DPG). CBD participants included Ian Griffiths, Simon Platt, and Andrew Beckett. Dr. Eugene Yee led the DRES team consisting of Geoff Chandler, Ray Chan, and Peter Kosteniuk. DPG participants included Christopher Biltoft (Test Director), Shayes Turley (Assistant Test Director), William Grayson, David Petrie, Pfred Toensing, and Mario Sandoval. LTC A.J. Kuehn represented DSWA at the test site, with DSWA contractors Drs. Gary Ganong and Edward Toton from Logicon RDA providing valuable technical assistance. Puff infrared imagery and FTIR spectrometry were provided by Aerospace Corporation under the direction of Dr. Kenneth Herr. Dr. Mark Polak of Aerospace Corporation provided downrange puff imagery and centroid position data, and John White of WDTC produced the meteorological data plots for Appendix A. Mrs. Susan Gross of WDTC provided word processing support.

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EXECUTIVE SUMMARY

Phase I of the Defense Special Weapons Agency (DSWA) Transport and Dispersion Model Validation test was conducted on a portion of the salt flats of the Great Salt Lake Desert on U.S. Army Dugway Proving Ground (DPG) in September 1996. The Phase I test objective was to acquire a puff ensemble database for validation of the next generation of puff dispersion models, specifically the Second Order Closure Integrated Puff (SCIPUFF®) model (Titan Corporation, 1996). DSWA sponsored the Phase I model validation test series as part of its counterproliferation model development and validation effort. Test participants included representatives from the British Chemical/Biological Defence (CBD) sector of the Defence Evaluation and Research Agency (DERA) at Porton Down, England, the Canadian Defence Research Establishment Suffield (DRES), and the U.S. Army West Desert Test Center (WDTC) at Dugway Proving Ground.

The DSWA Transport and Dispersion Model Validation Phase I test consisted of a series of tracer (propylene) puff releases into the atmosphere at distances ranging from 200 to 1200 m upwind of a line of photoionization detectors (PIDs). The multiple puff releases during each Phase I trial were conducted under well-documented meteorological conditions. A total of 32 trials with durations ranging from 30 to 120 min were completed. Data from these trials have been consolidated into 17 puff ensembles in the relative (puff-centered) frame of reference for use in validating the probabilistic prediction capabilities of SCIPUFF and other next generation models. This puff disemination series was the first phase of a model validation program that includes a series of long-range puff releases conducted in November 1996 and line source releases planned for September 1997.

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SECTION 1. INTRODUCTION

Responding to a shortfall in downwind hazard effects modeling identified during Operation Desert Storm, the Defense Special Weapons Agency (DSWA) has developed and is evaluating the performance of the Hazard Prediction and Assessment Capability (HPAC) model suite. HPAC includes nested atmospheric transport and diffusion models designed to provide desision makers with a tool for predicting windborne hazards that arise as a consequence of toxic materials released into the atmosphere. The HPAC development effort began with the recognition that the ensemble mean predictions available from the current generation of atmospheric dispersion models used for chemical and biological (CB) hazard assessments are of limited operational utility. Ensemble mean predictions provide an estimate of the concentrations or dosages that would be obtained by averaging the results for a large number of replications of the same release, but include no information about the distribution of single event concentrations or dosages. Current hazard assessment models also cannot estimate the probability of exceeding crucial hazard thresholds. These deficiencies complicate the interpretation of CB hazard model results and limit their usefulness in operational military situations.

Given the limited usefulness of ensemble mean predictions, DSWA identified the need for a probabilistic atmospheric dispersion model. In addition to providing a prediction of ensemble mean concentrations or dosages, a probabilistic dispersion model uses higher order statistical terms to define the probability that dosages or peak concentrations at points of interest exceed some crucial value specified by the user. This probabilistic output requires that the model be able to predict the concentration or dosage probability distribution function (PDF), which in turn requires that the model be able to predict both the concentration (or dosage) means and variances. SCIPUFF, which predicts the required means and variances through a second-order closure solution of the advection-diffusion equation, is the HPAC dispersion model component.

SCIPUFF uses a generalized Gaussian tensor to describe puff concentrations. The model's derivation begins by integrating the conservation equations to obtain differential equations for the concentration moments that explicitly include wind-shear effects. Second-order closure is used to relate these higher-order terms to turbulence parameters such a velocity cross-correlations and turbulence length scales. In contrast to current generation Gaussian puff models, SCIPUFF's second-order closure methodology yields predictions of dosage and concentration variances in addition to their ensemble means. These means and variances are applied in a clipped-normal distribution to predict concentration and dosage PDFs.

In the fall of 1995, DSWA contacted the Dugway Proving Ground (DPG) West Desert Test Center (WDTC) Meteorology & Obscurants Division (WD-M) for assistance in the development and implementation of a transport and dispersion model validation program. WD-M convened a meeting of atmospheric transport and dispersion modeling experts in February 1996 to recommend a model validation program. Attendees included representatives from the Joint Services, the National Oceanic and Atmospheric Administration (NOAA), and the trinational (U.S., UK, and Canada) Technical Panel 9 of The Technical Cooperation Program

(TTCP) Subgroup E on CB Defense. The meeting attendees reached consensus on the following points: (1) any model intended for use in CB hazard prediction assessment should undergo an independent technical evaluation; (2) in spite of the data set limitations, the VLSTRACK dispersion model validation performed using CB weapons test results formed a baseline against which future CB dispersion models should be compared. Recognizing the limitations of the data from CB weapons tests and previous field dispersion experiments, the attendees agreed that new data sets and model validation procedures were needed to validate SCIPUFF's probabilistic output. Consequently, the attendees suggested conceptual designs for a series of field tests to create high resolution puff data sets accompanied by detailed meteorological documentation that could be used to form ensembles for the validation of probabilistic models.

The DSWA Model Validation Program has two phases. Phase I, conducted 9-26 September 1996 at DPG, consisted of short-range (200 to 1200 m) puff releases for PDF determination. Phase II considers transport and diffusion to meso-scale distances (10 to 20 km). The first Phase II subtest was a series of puff releases conducted at the Nevada Test Site on 4-21 November 1996. The second subtest, which will consist of line source releases, is planned for DPG in September 1997 as a collaborative effort by the Joint CB Defense Contact Point and Test (DO49 Program), and the Naval Surface Warfare Center Dahlgren Division (NSWCDD), and DSWA. This report documents the Phase I test results.

SECTION 2. TEST DESCRIPTION

2.1 TEST SITE

Figure 1 shows the location of the DSWA Model Validation Phase I test. The Phase I test was conducted in an area surrounding Photo Pad 11 that extended 300 to 1700 m north of the Goodyear Road Causeway, which traverses the salt flats of the Great Salt Lake Desert (40° 8'N, 113° 26'W). The salt flats surrounding the test site form a smooth, vegetation-free salt crust surface over an old lake bed. The terrain is inclined towards the south with a slope of 1/10000 and has an extended upwind fetch unobstructed by wake-generating obstacles for several tens of kilometers. The test site elevation ranges between 1295 and 1296 m above mean sea level (MSL). The lake bed surface is often wet in the winter, and a new salt crust forms as water evaporates in the spring. This annual process produces a nearly uniform surface with a roughness length z_o of less than 1 mm. The smooth, uniform, flat surface with low slope and few turbulence-generating obstacles make this site an ideal location for baseline atmospheric dispersion experiments because there are few upwind roughness features or terrain obstacles to induce wind meander.

2.2 FIELD TEST DESIGN

The Phase I field test consisted of the near-surface release of propylene puffs as a tracer gas with sampling at downwind distances of 200, 300, 400, 800, or 1200 m. Figure 2 shows the test site layout. The puffs were released from one to eight "air cannons," each of which contained 0.36 kg of propylene. The sampling lines were instrumented with photoionization detectors (PIDs) stationed at a height of 1.5 m above ground level (AGL). The fast-response (on the order of 50-Hz) PIDs were used to define the detailed structure of each puff as it passed through the sampling lines. The PID measurements were supplemental with meteorological measurements and infrared (IR) imagery. Meteorological measurements included surface and upper-air observations; longwave and shortwave radiation; and wind, turbulence, and temperature profiles. The standard weather observations and pilot balloon (pibal) and tethersonde flights were performed at the surface observing site, which was along Goodyear Road 1000 m southwest of the test site. Wind and turbulence measurements were made at 0.5, 1.0, 2.0, 4.0, and 8.0 m AGL by sonic anemometer/thermometer arrays (sonics) mounted on towers positioned along the west and east sides of Photo Pad 11. The northwest tower also included temperature measurements at the surface and at 0.5, 1.0, and 2.0 m AGL. The radiation measurement platform was stationed 30 m west of the northwest tower. Remote sensing support included IR cameras positioned south and west of the test grid to capture initial puff dimensions and to track each puff as it moved downrange. A Fourier-transform infrared (FTIR) spectrometer was also used to track puff movement.

The dissemination system and primary (TIPSJ3A digiPID) sampling line was set up and operated under contract to WDTC by S+J Engineering, Inc. (now Aurora Engineering, Inc. of Aurora, Ontario, Canada). S+J Engineering, in cooperation with DRES, also performed the reduction and analysis of the digiPID puff data. The S+J Engineering final report (Chandler, 1997) includes

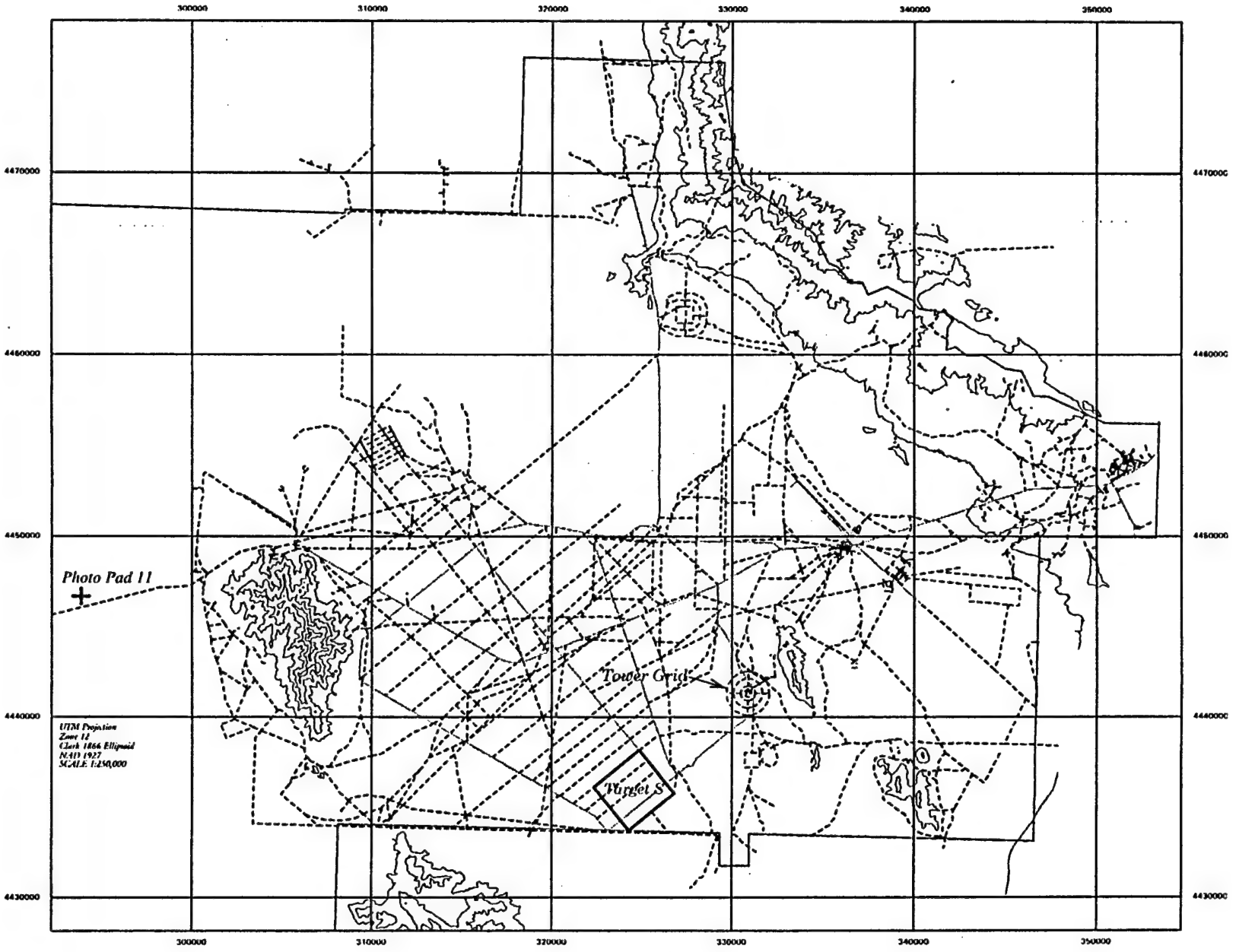

Figure 1. Dugway Proving Ground, showing the location of the Photo Pad 11 test site. Map courtesy of Mr. James Mikkelsen, U.S. Army Dugway Proving Ground Environmental Programs Office.

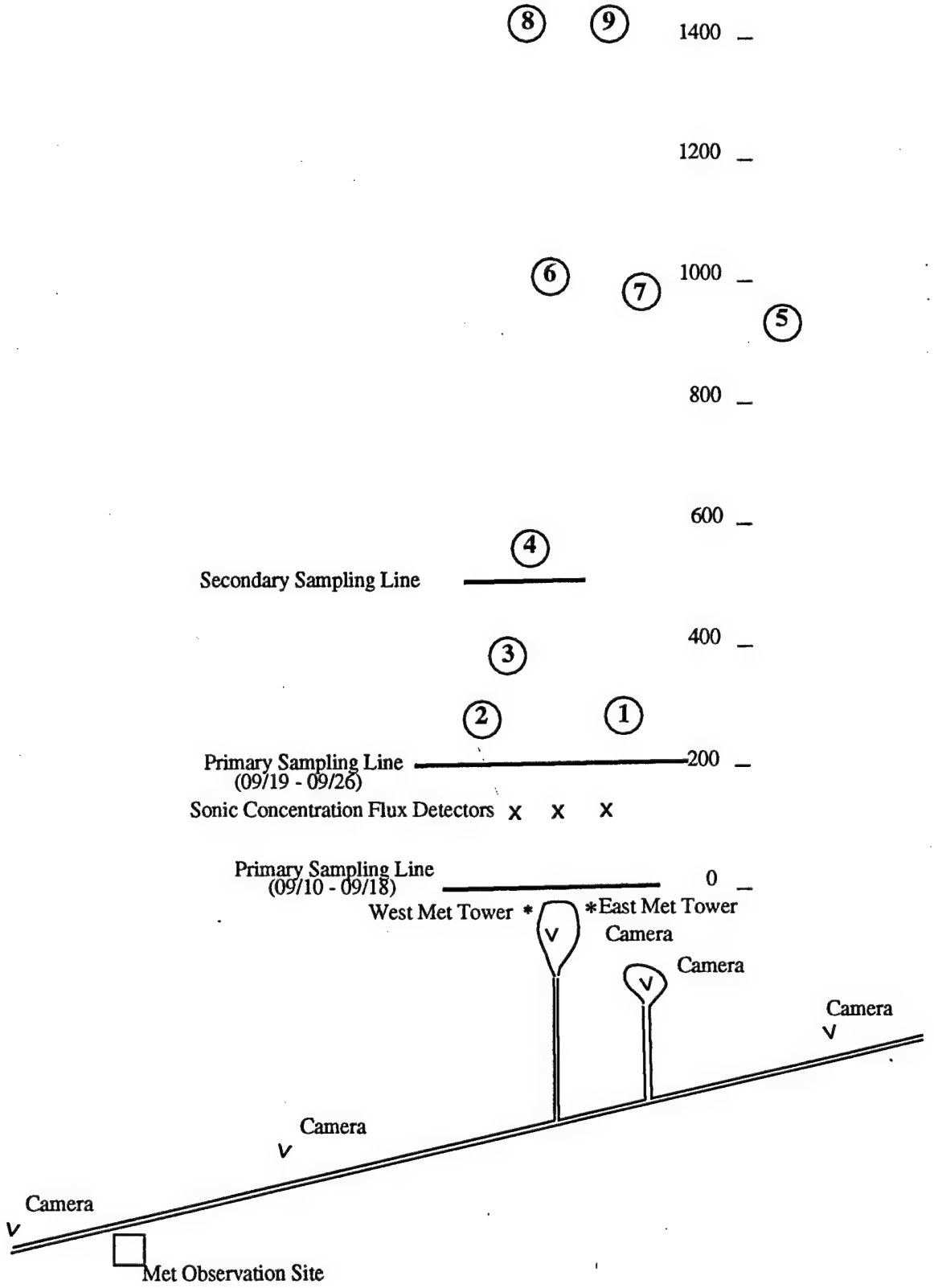

Figure 2. Site Layout for the DSWA Model Validation Phase I (Puff Dissemination) test. Numbers enclosed in circles refer to puff release locations (see Table 1).

detailed information on each puff disseminated and organizes the puffs into ensembles in the relative (puff-centered) frame of reference. A secondary sampling line of PIDs (UVICs) was operated by CBD, meteorological support was provided by WDTC, and WDTC and Aerospace Corporation (a DSWA contractor) provided IR imagery and spectrometry. CBD and Aerospace Corporation will provide their data in separate reports.

2.3 TEST INSTRUMENTATION

2.3.1 Puff Disseminators

The puff dissemination device was an "Air Cannon" (patent pending), a commercially available disseminator produced by Vibco, Inc. of Mississauga, Ontario, Canada. An Air Cannon can release up to 0.36 ±0.02 kg of gaseous propylene within 1 s and recharge within 30 s for the next release. It consists of a pressurized cylinder, a quick-acting poppet valve, a solenoid fill and release control valve, and a high volume exhaust valve. The solenoid valve controls both filling and release. Vibco Air Cannons were customized by S+J Engineering, Inc. (now Aurora Engineering, Inc.) to meet the specific Phase I test needs. These needs included portability and a computer-operated, remote-controlled gas fill and release system. Because of its weight (48 kg), each Air Cannon was mounted on a wheeled dolly, to provide the mobility required for moving the disseminators to their positions. The fill system includes temperature and pressure sensors designed to ensure a cylinder fill accuracy of ±5%. The fill procedure is performed using a microprocessor controller that responds to commands sent through a radio modem linked to a personal computer (PC). The PC controller also accepts fill requirements from the operator and logs release data. The Air Cannons can be fired singly or in combination. A total of nine Air Cannons, operated in user-selected configurations, were used in the Phase I test, providing a capability to release up to 3.2 kg of propylene in 0.36-kg increments. Details of the puff disseminator design and operation are available in the S+J Engineering, Inc. design report (Chandler, 1996).

2.3.2 Photoionization Detectors

Propylene gas concentrations downwind of the Air Cannons were sampled using PIDs. A PID consists of a collector tube through which air is drawn by a fan mounted towards the rear of the instrument. The airstream drawn through the tube is exposed to a 10.6-eV ultraviolet lamp. A portion of the gases within the airstream that have an ionization potential of less than 10.6 eV are ionized, and the ions impinge upon electrically-biased collector plates downstream of the lamp. Voltages are generated by ions collecting on these plates. The voltage-to-concentration relationship for each PID is established through calibration. The Ultra-Violet Ion Collector (UVIC®) and the digiPID model TIPSJ3A were the two types of PIDs used during the test program.

The CBD-operated UVICs feature a direct current (dc) driven krypton ultraviolet lamp, which enhances calibration and baseline stability. A flow rate of 40 l/min through the collector tube minimizes lamp window fouling and ion recombination prior to collection. The UVIC detectors operate over a calibratable range of 0.01 to 1000 parts per million (ppm) by volume of

propylene (Griffiths, 1993). Data generated at a 50-Hz rate are transmitted to a PC-based acquisition system via packet radio telemetry.

The digiPID features micro-processor control, a 20-bit analog-to-digital converter, and 50-Hz frequency response. The digiPID sensitivity is about 0.04 ppm with a maximum range in excess of 1000 ppm for propylene in air (Chandler, 1996). It is housed in an aluminum case which is 5.1 cm high, 7.6 cm wide, and 22.2 cm long. All instrument functions (on-off switching, gain control, and zeroing) are controlled remotely from a PC.

2.3.3 Sonic Anemometer/Thermometers

A sonic anemometer/thermometer (sonic) consists of a transducer array containing paired sets of ultrasonic transmitters and receivers, a system clock, and circuitry designed for measuring intervals of time from the transmission to the reception of sound pulses transmitted between transducer pairs. The sonics used in the Phase I test were the Applied Technologies, Inc. (ATI) 2-axis Model RSWS-201/2A, which provides horizontal (u and v) wind components and speed of sound, and the 3-axis ATI Model RSWS-201/3A, which provides three dimensional (u, v, and w) wind components and speed of sound. The 2-axis sonics were mounted at 0.5, 1.0, and 4.0 m AGL and the 3-axis sonics were mounted at 2.0 and 8.0 m AGL. The 2-axis sonics measured the horizontal wind vector, while the 3-axis sonics resolved the three-dimensional wind vector. The speed of sound measurements were converted to sonic temperature, which is essentially the same as virtual temperature. With a data rate of 10 Hz and an acoustic pathlength between transducers of 15 cm, the sonics provided sufficient temporal and spatial resolution to measure mean wind plus the fluctuating components needed to define turbulence intensities and the fluxes of heat and momentum. The American Society for Testing of Materials (ASTM) standard practice for obtaining wind and temperature measurements from sonics (ASTM D 5527-94) was used to obtain wind component and speed of sound measurements to within ± 3 cm/s.

2.3.4 Quartz Thermometer

Temperature measurements were taken at and immediately above the ground surface (0.0, 0.5, 1.0, 2.0 m AGL) using the Ipitek, Inc. quartz thermometer. The thermometer sensor is a small (1-mm diameter) quartz crystal machined so that its resonance frequency is temperature dependent. Four quartz sensor probes are connected by fiberoptic leads to the microprocessor-based thermometer, which converts sensor oscillating frequencies to temperatures. The probe unit permits the simultaneous collection of temperatures at four locations with an inter-probe accuracy of within several thousanths of a degree, which is sufficient for near-surface temperature profiling. Because of the probe's small mass and thermal inertia, response time in air is between 2 and 3 s. The probes were mounted naturally aspirated and unshaded on the west meteorological tower under the assumption that each probe would receive comparable levels of direct and reflected solar radiation.

2.3.5 Hot-Wire Anemometer and Concentration Flux Probes

Hot-wire anemometers provide the very fast response (on the order of several thousand Hertz) fine scale velocity component measurements required to resolve turbulent motions very near the surface. The hot-wire system consists of fine wire (5-μm diameter) probes, a sensitive amplifier connected to fast-response circuitry, and a data acquisition system. Each exposed hot-wire element is mounted in a Wheatstone bridge circuit that is balanced to maintain the sensor at a constant, user-defined temperature which is set to be warmer than the ambient temperature. Air flowing across the sensor cools the exposed wire, and the bridge network responds by sending current through the element until balance is restored. System electronics measure and record the resulting voltage changes across the bridge. Hot-wire anemometers typically resolve air motions to within ±5 cm/s.

Three hot-wire anemometers were paired with collocated fast-response PIDs to obtain the coincident tracer gas concentration and wind component data required to compute a concentration flux. The hot-wire system, which was designed and operated by the University of Utah Department of Mechanical Engineering, used a fast-response PID provided by S+J Engineering. These eddy correlation measurements were part of an adjunct methodology experiment rather than the main test. The concentration flux measurement system and methodology test setup are described by Metzger et al. (1997), and the results will be published in follow-on reports.

Three experimental concentration flux probes, each consisting of a 2-axis sonic and a coaxially-mounted digiPID, were fielded during this test program. The 2-axis sonic array was mounted with a 90° rotation, placing the u-axis in a position to measure the vertical wind component. This arrangement permits a direct measurement of the vertical concentration flux. The three sonic concentration flux probes were positioned 120 m north of the initial primary sampling line (see Figure 2) at a height of 1.5 m. An assessment of the performance of this experimental measurement system is beyond the scope of this report, but will be the subject of future investigations.

2.3.6 Pibal

The pilot balloon (pibal) is an optically-tracked free balloon that is used to obtain profiles of wind speed and direction. Thirty gram (30-g) pibals were used for boundary layer wind profiling during this test program. When filled to its design lift weight, a 30-g pibal has an ascent rate that is large in comparison with typical atmospheric vertical motions. Standard tables are used to relate a pibal's flight time to its height AGL. Optical tracking with a theodolite provides azimuth and elevation readings taken at 30-s or 1-min intervals. These readings, combined with tabulated height versus time data, provide sufficient information to calculate layer-averaged wind speeds and directions. Pibal wind profiles are typically accurate to within ±2 m/s (RCC-MG, 1992). Pibal wind profile shear and velocity maxima were used to estimate mixing heights (depths) for the trials without tethersonde soundings.

2.3.7 Tethersonde

The AIR, Inc. tethersonde is an aerodynamically-shaped balloon with a volume of 4.25 m^3 and lift capacity of 1.5 kg. The balloon is tethered to an electric winch. A small instrument package containing temperature, humidity, pressure, and wind sensors is suspended below the balloon. The balloon ascends and descends under operator control, providing temperature, humidity, and pressure profiles. Wind speed is determined using a cup anemometer attached to the instrument package and wind direction is determined from balloon orientation with respect to true north. Tethersondes were used to obtain wind and thermodynamic profiles between the surface and 600 m AGL during the Phase I test. Typical tethersonde measurement accuracies are ±1 m/s for winds, ±0.2 °C for temperature, and ±10% for humidity (RCC-MG, 1992). Tethersonde-derived temperature and humidity profiles were used to estimate mixing heights.

2.3.8 Infrared Imaging Radiometers

Infrared imaging radiometers (imagers) are passive optical devices sensitive to IR radiation in the 8- to 12-μm portion of the IR spectrum. Because propylene has a broad absorption spectrum between 10 and 12 μm, the passage of a propylene puff across the imager's field of view registers as a temperature change when compared with the background image. Infrared imagers were used to determine initial puff dimensions (source size) and to track the puffs as they traversed the sampling lines. Source size characterization was done using an Inframetrics Model 600L Imaging Radiometer, which has a typical thermal sensitivty of 0.05 °C, a scan rate of 50 Hz, and a 7-bit (128 levels) image resolution. Three Sterling-cooled Agema Thermovision 900 digital IR imagers, each equipped with a narrowband filter centered around the main propylene absorption band (inverse wavelength of 912 cm^{-1}), were used to monitor propylene puff travel across the sampling lines. These imagers are characterized by a 15-Hz scan rate (non-interlaced) and a thermal sensitivity of 0.08 °C. The spectral band pass and field of view varied with the filters and lenses used.

2.3.9 Fourier Transform Infrared Spectrometer

The Fourier transform infrared spectrometer (FTIR) is a remote imaging device designed to measure the scene spectrum within the 8- to 12-μm band. Because all materials that absorb IR energy have unique abosorption band signatures, an FTIR is able to resolve the contents of a dispersing cloud. Propylene has a unique absorption peak at an inverse wavelength of 915 cm^{-1} and a column density detection limit for a clear sky background of approximately 20 ppm-m (Dr. Ken Herr, personal communication). The FTIR is most useful when the background within the field of view is constant and the target cloud is easily distinguishable from the background signature. Consequently, the FTIRs were oriented towards the clear sky during the Phase I test to detect the arrival and passage of the propylene puffs across the field of view. Propylene cloud and background spectral radiance data taken from the FTIR can be used with propylene database information to calculate cloud column density. The FTIR supporting this test was an Intillitec M21 chemical agent detector. This instrument features a spectral resolution of 3.0 cm^{-1}, a

5.25-Hz scan rate, a 25-milliradian field-of-view, and a sensitivity of 1.5 x 10^{-8} W cm^{-2} sr^{-1}/cm^{-1}. Spectrometers were mounted in the Aerospace Corporation Ram Van stationed on Pad 11 and in the Aerospace Tonka Van that traveled along Goodyear Road.

2.3.10 Actinometers

Actinometers provide measurements of solar and terrestrial radiation, which can be used to define the incoming and outgoing long- and shortwave radiation and radiative balance. Eppley pyranometers were used to obtain hemispheric incoming and outgoing shortwave radiation (the 0.3- to 4.0-μm wavelength band), and Eppley pyrgeometers were used to obtain hemispheric incoming and outgoing longwave radiation (the 4.0- to 50-μm band). The pyranometers and pyrgeometers were mounted in pairs on booms 1 m above an undisturbed section of the salt flats surface with one of each facing towards the sky and the other facing towards the surface. All instruments were leveled to measure radiation from above or below the horizontal plane. This arrangement provided incoming and outgoing long- and shortwave radiation through a plane 1 m above the surface. Actinometer readings were logged every 5 s and averaged over selected trial periods. The actinometer platform was positioned 12 m west of the west meteorological tower at a location free from shadows.

Pyranometers consist of thermopiles, a series of thermoelectric junctions between two dissimilar metals, covered by a Schott glass dome which passes radiation in the visible part of the spectrum. A temperature gradient is created by placing one set of junctions in thermal contact with a nonwavelength-selective black surface and isolating the other set. The temperature gradient produces a voltage that is proportional to the temperature difference and hence to the intensity of incident radiation. The pyrgeometers are of similar design except that the covering dome is designed with a bandpass for longwave radiation.

SECTION 3. TRIAL DATA SUMMARIES

3.1 PROPYLENE SAMPLER DATA

3.1.1 Trial Number And Time Convention

The trial number convention for the DSWA Model Validation Phase I test consists of the three-digit Julian date (JJJ) followed by the hour and minute of trial start time in Mountain Daylight Time (MDT), forming a trial name of JJJhhmm. All data were collected in Universal Coordinated Time (UTC), which is 6 hours ahead of MDT. Many of the trials were conducted during the evening UTC transition across midnight. Consequently, the trial name Julian date (in MDT) is sometimes a day behind the Julian date recorded with the data for that trial.

3.1.2 Trial Overview

The DSWA Model Validation Phase I test began on 9 September 1996 and was completed on 26 September 1996. The first half of the test was dominated by the "summer monsoon" which produced winds from the south through west and an influx of humidity and convection. The test grid had been designed for climatologically average conditions, which favor thermally-driven winds from the northwest through north in the afternoon and evening hours. Consequently, the southerly wind components and the convection, which produced erratic wind directions and lightning hazards, limited the number of trials accomplished during the first two weeks of the test. Widespread rain cancelled test activities on 16 September, but a northerly flow set in on 17 September. All of the useable puff dissemination data were collected from 17 through 26 September 1996 (Julian dates 261 through 270). The primary sampling line detectors, initially located 8 m north of Photo Pad 11, were moved on 19 September (JJJ=263) to new positions 200 m north of Photo Pad 11. This move was made to eliminate possible flow distortion effects from data acquisition equipment stationed on Photo Pad 11.

Although winds were generally unfavorable for puff releases during the first half of the Phase I test, 30-min continuous releases were done beginning at 1810 MDT on 10 September (Trial 2541800), and at 1744 MDT (Trial 2551730) and 1830 MDT (Trial 2551830) on 11 September. The primary purpose of these releases was to exercise the IR imagers and spectrometers using a propylene source. A few balloons filled with SF_6 were also released for the same reason. One 30-min series of puff releases was made in southerly winds from a position 300 m north of the grid centerline at 1700 MDT on 12 September. This release was designed to exercise the puff disseminators and the UK sampling line located 500 m north of grid center. None of these preparatory activities are included in the summaries in this report.

3.1.3 Puff Ensemble Summaries

A total of 30 puff trials were completed between Julian dates 261 and 270. Of these, 23 produced puff data along the TIPSJ3A sampling line of sufficient quality to be grouped for statistical analysis. These data sets were organized into ensembles based on the following criteria: (1) release distance,

(2) wind speed, and (3) turbulence intensity. A total of seventeen ensembles (R01 through R17) were formed from these 23 high quality data trials. Each ensemble name consists of the ensemble number and a three- or four-digit number which identifies the nominal distance between the disseminator and the TIPSJ3A sampling line.

Table 1 summarizes the puff ensembles, including the trial number(s), start and stop times, release distance, detector spacing, release location (referenced to Figure 2 and Table 1), and number of useable puffs. Estimation of the initial alongwind puff dimensions shown at the far right of Table 1 is discussed in the next section. Table 2 gives the decimal latitude and longitude positions (1983 North American Datum, NAD) of the most significant test site locations, including release locations. The sampler lines, camera positions, and release locations are also shown on Figure 2.

3.1.4 Puff Dimensions And Mass

As discussed in Section 2.3.1, puffs were disseminated from one or more Air Cannons, with fill and release operated and monitored by PC computer control. The computer-controlled puff release system permitted the operator to select puff intervals, which were based on wind speed and travel distance, to produce a maximum number of puffs per trial while retaining a well defined clear-air interval between puffs. A single Air Cannon was used for release distances of 200 m and 300 m, two Air Cannons were used for releases at 400 m, four cannons were used at 800 m, and eight were used at 1200 m. The release from each Air Cannon was nominally 0.36 ±0.02 kg, and each puff release was completed in 0.3 ±0.1 s. The released mass diminished towards the end of several long distance trials because of decreasing gas cylinder pressure.

An IR imager positioned 75 m crosswind from the disseminator array (consisting of Air Cannons, gas cylinders, control boxes, hoses and cabling) monitored a number of the releases in an effort to determine characteristic source dimensions. Puff dimensions were defined from pixel counts on the image that contained the last identifiable bit of gas emitted from an air cannon. The pixel resolution was 0.25 m.

Puff vertical dimensions derived from IR imagery were fairly consistent at 2.2 ±0.4 m, but the horizontal dimensions exhibited considerable scatter, especially with releases from multiple air cannons. Imagery showed that a typical Air Cannon functioning in light wind produces a toroidal puff 4 ±1 m in diameter, but that not all of the Air Cannons functioned identically or simultaneously. Simultaneous gas releases from multiple Air Cannons actually varied by about 0.2 to 0.4 s. This additional time translated into a wind-speed-dependent elongation of the alongwind puff dimension. Also, power fluctuations from the generator used for the release site IR imager produced variations in image quality that impeded cloud dimension identification. Therefore, direct interpretation of horizontal puff dimensions from the IR imager was abandoned in favor of an empirical approach.

An empirical puff alongwind dimension algorithm based on average Air Cannon performance was used to estimate horizontal puff dimensions as a function of wind speed. Although a torus of disseminated gas is expected to

Table 1. Puff Ensemble Summary.

Ensemble Name	Trial Number(s) (JJJhhmm)	First Release (UTC)	Last Arrival (UTC)	Release Distance (m)	Detector Spacing (m)	Release Location	Released Mass (kg)	Number Useable Puffs	Alongwind Dimension (m)
R01-200	2631715	23:15	23:45	192	6	2	0.37	17	5.8
	2631745	23:47	23:51	192	6	2	0.37	3	5.8
R02-200	2631800	00:02	00:27	192	6	2	0.36	11	5.8
R03-200	2631900	01:00	02:03	192	6	2	0.36	29	5.2
R04-300	2611844	00:44	01:28	299	8	1	0.36	14	4.4
	2612016	02:16	02:36	299	8	1	0.36	10	4.1
R05-400	2671900	19:00	19:38	356	6	3	0.73	18	6.2
R06-400	2671420	20:20	21:17	356	6	3	0.71	9	5.4
	2671540	21:57	22:39	356	6	3	0.75	8	5.4
R07-400	2671648	22:48	23:50	356	6	3	0.73	19	5.9
R08-400	2671810	00:10	01:12	356	6	3	0.74	31	6.5
R09-400	2671934	01:34	02:36	356	6	3	0.75	31	6.6
R10-400	2672044	02:44	03:11	356	6	3	0.74	12	5.9
R11-800	2691105	17:05	18:19	814	10	4	1.42	31	9.4
R12-800	2691355	20:01	21:06	814	10	4	1.33	20	9.1
R13-800	2691540	21:42	23:49	776	10	6	1.35	35	8.0
R14-800	2691800	23:59	00:55	776	10	6	1.34	22	7.3
R15-800	2691800	00:54	01:48	776	10	6	1.33	12	6.7
R16-1200	2701256	19:05	19:14	1203	10	7	2.73	2	9.2
	2701405	20:21	21:55	1203	10	7	2.40	13	9.4
	2701645	22:48	23:46	1203	10	7	2.15	7	9.1
R17-1200	2701915	01:23	02:07	1198	10	8	1.90	11	8.3
	2702022	02:22	03:01	1198	10	8	1.65	8	8.3

Table 2. Significant Test Site Locations (1983 NAD).

Position	Latitude (°N)	Longitude (°W)
Photo Pad 11	40.14172	113.43544
East Met Tower	40.14153	113.43508
West Met Tower	40.14153	113.43600
Causeway Intersection	40.13836	113.43531
Met Observer Site	40.13619	113.44439
Primary Line West (9/10-9/18)	40.14181	113.43764
Primary Line East (9/10-9/18)	40.14189	113.43322
Primary Line Center (9/10-9/18)	40.14185	113.43543
Primary Line West (9/19-9/26)	40.14358	113.43820
Primary Line East (9/19-9/26)	40.14372	113.43267
Primary Line Center (9/19-9/26)	40.14365	113.43543
West Agema Camera	40.13581	113.44656
West Agema IR Imager	40.13631	113.44453
East Agema IR Imager	40.14039	113.43331
ACAM3	40.14028	113.43350
Photo-11 #2 Geodetic	40.14178	113.43561
Camera Site	41.14044	113.43326
Release Location 1	40.14436	113.43400
Release Location 2	40.14431	113.43686
Release Location 3	40.14522	113.43639
Release Location 4	40.14681	113.43590
Release Location 5	40.15009	113.43074
Release Location 6	40.15079	113.43548
Release Location 7	40.15055	113.43364
Release Location 8	40.15452	113.43603
Release Location 9	40.15447	113.43435

form around a functioning Air Cannon in calm air, the puff becomes elongated in the downwind direction if there is any wind. The initial puff dimension algorithm assumed a no-wind puff torus outer diameter of 3 m for a single Air Cannon, 4 m for two Air Cannons, and 5 m for 4 or more Air Cannons. The product of the time required for the gas to exit the Air Cannon with the transport wind speed was added to the torus diameter to account for alongwind cloud growth during dissemination. The puff formation time was assumed to be 0.4 s for a single Air Cannon and 0.6 s for multiple Air Cannons. The resultant alongwind cloud dimension estimates are included in the far right column of Table 1. Because wind speed has little effect on crosswind puff dimensions, the initial crosswind dimension for puffs produced by a single Air Cannon or dual Air Cannons aligned along the direction of the wind was assumed to be nominally 4 ±1 m. For a cluster of four to eight Air Cannons, where two or more were aligned crosswind from each other, the initial crosswind puff dimension was estimated to be 5 ±2 m.

3.2 METEOROLOGICAL SUMMARIES

3.2.1 Surface Observations And Upper-Air Summaries

Surface weather observations of temperature, relative humidity (RH), pressure, visibility, cloud cover, and sensible weather were taken hourly during the Phase I test. Wind speed and direction were also measured at a height of 2 m AGL at three locations: near Photo Pad 11, 1 km north of Photo Pad 11, and at the weather observation station 800 m southwest of Photo Pad 11. The weather observation most representative of conditions during each trial is presented in Table 3. Pibal and/or tethersonde flights were also taken during the trials to provide wind and temperature profiles through the depth of the boundary layer. Detailed pibal and tethersonde flight profiles and time series plots of the 2-m wind speed and direction are presented in Appendix A. Mixing depths estimated from the pibal and tethersonde profiles are included in Table 3.

3.2.2 Trial and Ensemble Micrometeorological Summaries

The sonic data from the 2- and 8-m levels on the east and west towers were reduced to statistical summaries for each trial. These summaries include mean wind speed and direction, wind component and temperature variances and covariances, and turbulence intensities. These trial-averaged statistical summaries are presented in Appendix B. Micrometeorological summaries were also formed for the selected puff ensembles. These ensemble summaries include the wind speeds measured at 2 and 8 m, and the derived quantitites of transport velocity, friction velocity, and Obukhov length. Transport velocity was derived from the average time from puff release to arrival at the sampling line. Friction velocity and Obukhov length were derived from bandpass-filtered sonic data using Monin-Obukhov similarity theory algorithms (Chandler, 1997). (A bandpass filter was applied to remove trends and signals with periods greater than 10 min or less than 0.2 s from the sonic data.) The resultant quantities are given in Table 4. Table 5 gives corresponding filtered wind component variances, temperature variance, and wind component and temperature covariances for the sonic data for each puff ensemble.

Table 3. Surface Weather Observations for the DSWA Phase I Model Validation Trials.

Trial Name	Wind Dir (deg)	2-m Wind Speed (m/s)	Temp. (c)	RH (%)	Pres (mb)	Visibility (km)	Cloud Cover (1/10)	Est. Mixing Depth (m)	Remarks
2541800	295	2.1	30.7	19	870.1	80	8	216	ISOLD CB ALQDS
2551730	027	3.0	31.1	20	868.0	80	2	600-700	
2551830	030	4.2	30.1	21	867.2	80	1	706	
2561700	169	7.2	30.0	16	862.2	80	6	706	LN CB S-N RWU SW-NW ISOLD CB ALQDS
2611844	347	3.8	13.0	38	871.4	80	3	315	ISOLD CB AND RWU ALQDS
2612016	308	3.8	10.6	54	871.6	80	3	216	ISOLD CB AND RWU ALQDS
2631800	051	6.1	18.7	29	872.0	80	5	414	ACSL S-W
2631900	043	4.9	16.5	35	872.1	80	6	542	
2651640	330	1.7	28.8	16	864.5	80	2	260	
2651904	325	3.8	26.6	18	863.0	80	4	55	
2652044	336	4.3	23.9	24	862.9	80	5	55	
2671300	001	4.3	16.0	15	874.4	80	0	414	
2671420	011	2.4	18.7	20	873.5	80	0	414	
2671540	004	2.1	21.1	19	872.4	80	0	470	
2671648	355	3.1	21.1	19	871.6	80	0	424	DSNT TCU SE-SW
2671810	351	4.4	20.5	21	870.9	80	0	239	ISOLD DSNT CB SE-SW
2671934	344	4.7	18.7	23	870.7	80	0	239	
2672044	334	3.2	16.8	27	870.8	80	0	104	
2681700	020	5.9	25.3	12	868.0	80	2	201	
2681936	332	2.6	22.0	22	867.4	80	6	216	
2691105	018	8.0	15.7	19	871.2	80	10	315	
2691244	024	8.6	17.2	15	870.5	80	10	414	
2691355	019	7.5	17.8	14	869.9	80	10	414	
2691542	023	4.8	19.0	11	869.3	80	9	801	
2691800	017	2.9	19.5	10	868.1	80	6	801	
2701256	346	6.2	14.9	20	869.8	80	0	>1350	
2701405	013	7.6	16.6	17	869.7	50	1	>1170	
2701630	013	6.7	17.0	16	869.5	50	2	801	
2701915	011	4.9	14.9	16	870.1	50	4	990	
2702022	004	4.7	13.2	18	870.8	50	1	414	

Table 4. Puff Ensemble Micrometeorological Summary.

Ensemble	Temperature				Wind Speed		Transport Velocity (m/s)	Friction Velocity		Obukhov Length	
	0.0 m (°C)	0.5 m (°C)	1.0 m (°C)	2.0 m (°C)	2m (m/s)	8m (m/s)		2m (m/s)	8m (m/s)	2m (m)	8m (m)
R01-200	23.07	16.80	16.21	16.12	5.9	6.8	6.9	0.26	0.23	-18	-12
R02-200	20.59	16.68	16.18	16.09	5.6	6.6	7.0	0.26	0.25	-36	-32
R03-200	16.75	15.95	15.77	15.80	4.6	5.4	5.8	0.20	0.19	-79	-93
R04-300	13.46	11.17	11.24	11.34	3.6	4.1	3.6	0.16	0.15	-20	-28
R05-400	18.38	17.69	17.51	17.58	3.6	4.0	3.7	0.20	0.17	-4	-3
R06-400	29.51	19.52	19.11	18.93	2.0	2.2	2.3	0.08	0.11	-0.4	-1.1
R07-400	28.10	21.09	20.60	20.39	3.2	3.5	3.2	0.15	0.19	-3	-7
R08-400	23.40	20.27	19.95	19.75	4.4	4.9	4.2	0.19	0.19	-18	-19
R09-400	18.38	17.69	17.51	17.58	4.6	5.4	4.3	0.19	0.20	-207	+7835
R10-400	17.03	16.39	16.25	16.37	3.4	4.1	3.2	0.16	0.14	+226	+80
R11-800	19.92	16.98	16.48	16.42	7.4	8.7	7.4	0.34	0.34	-72	-77
R12-800	23.74	18.89	18.19	17.98	6.9	7.9	6.8	0.30	0.30	-25	-26
R13-800	25.88	19.82	19.09	18.90	4.5	5.2	5.0	0.21	0.22	-11	-12
R14-800	20.12	18.12	17.78	17.83	3.7	4.3	3.9	0.18	0.19	-34	-37
R15-800	16.70	16.16	16.03	16.18	2.7	3.3	2.9	0.11	0.11	+74	+104
R16-1200	22.15	16.98	16.41	16.16	7.1	7.9	7.2	0.32	0.36	-21	-29
R17-1200	13.90	13.68	13.58	13.74	5.1	6.3	5.5	0.25	0.24	+133	+118

Table 5. Puff Ensemble Micrometeorological Variances and Covariances. [a]

Ensemble	u'u'		v'v'		w'w'		T'T'		u'w'		w'T'	
	2 m (m^2/s^2)	8 m (m^2/s^2)	2 m (m^2/s^2)	8 m (m^2/s^2)	2 m (m^2/s^2)	8 m (m^2/s^2)	2 m (K^2)	8 m (K^2)	2 m (m^2/s^2)	8 m (m^2/s^2)	2 m (m K/s)	8 m (m K/s)
R01-200	0.603	0.564	0.709	0.674	0.087	0.146	0.322	0.150	-.0669	-.0509	.0730	.0725
R02-200	0.466	0.347	0.557	0.547	0.076	0.098	0.108	0.059	-.0652	-.0625	.0370	.0363
R03-200	0.352	0.385	0.297	0.281	0.053	0.070	0.011	0.007	-.0395	-.0369	.0076	.0058
R04-300	0.213	0.183	0.184	0.161	0.037	0.045	0.033	0.011	-.0265	-.0214	.0155	.0086
R05-400	0.432	0.416	0.684	0.667	0.077	0.156	0.776	0.239	-.0394	-.0277	.1404	.1109
R06-400	0.437	0.370	0.477	0.445	0.058	0.141	0.567	0.168	-.0050	-.0005	.1103	.0948
R07-400	0.378	0.381	0.424	0.396	0.052	0.127	0.411	0.142	-.0209	-.0354	.0780	.0763
R08-400	0.320	0.280	0.295	0.294	0.050	0.079	0.091	0.041	-.0360	-.0366	.0293	.0280
R09-400	0.245	0.182	0.091	0.069	0.051	0.057	0.003	0.002	-.0376	-.0396	.0026	-.0001
R10-400	0.137	0.084	0.064	0.054	0.034	0.033	0.002	0.002	-.0254	-.0191	-.0013	-.0026
R11-800	0.784	0.601	0.479	0.446	0.129	0.159	0.082	0.051	-.1132	-.1104	.0409	.0382
R12-800	0.907	0.854	0.749	0.722	0.117	0.167	0.326	0.178	-.0841	-.0890	.0847	.0790
R13-800	0.641	0.649	0.570	0.603	0.067	0.126	0.301	0.126	-.0416	-.0452	.0688	.0676
R14-800	0.239	0.254	0.182	0.181	0.039	0.058	0.024	0.014	-.0303	-.0346	.0121	.0136
R15-800	0.099	0.083	0.044	0.039	0.018	0.020	0.004	0.004	-.0118	-.0114	-.0013	-.0009
R16-1200	1.087	1.156	0.863	0.951	0.129	0.208	0.533	0.249	-.0991	-.1268	.1171	.1197
R17-1200	0.378	0.292	0.141	0.132	0.074	0.086	0.010	0.009	-.0601	-.0590	-.0082	-.0091

[a] u'u' = alongwind velocity variance, v'v' = crosswind velocity variance, w'w' = vertical velocity variance, T'T' = temperature variance, u'w' = alongwind-vertical velocity covariance, and w'T' = temperature-vertical velocity covariance.

3.3 PUFF IMAGERY

3.3.1 Description

Aerospace Corporation positioned IR imagers and spectrometers at the locations shown on Figure 2. The principal measurement objective was to document movement of each puff from the disseminator to the point where it crossed the primary sampling line. In some cases, the puffs were also tracked across Goodyear Road. The majority of puff position measurements were obtained for Julian dates 263 and 267, documenting puff positions for Ensembles R01, R02, R03, R06, R07, R08, R09, and R10. Time-tagged puff imagery are available on compact disk (CD) read only memory (ROM).

3.3.2 Puff Centroid Estimates

Aerospace Corporation used the puff imagery to estimate puff centroid positions. Centroids were estimated manually using the puff center of mass determined from imagery from two or three camera sites. The centroid positions at selected times were defined by their horizontal and vertical distances in meters from the release point. Puff centroid heights as the puffs crossed the primary sampling line are of particular interest because tracer concentrations received at the sampling line diminish with puff centroid distance above that line. Table 6 summarizes the available puff centroid height estimates at the primary sampling line for each ensemble. The table gives the puff ensemble centroid height means and standard deviations along with the number of puffs used to form each ensemble.

Table 6. Puff Ensemble Centroid Heights.

		Centroid Height (m)		
Ensemble	Trial	Mean	Std. Dev.	Number Puffs
R03-200	2631900	5	2	14
R06-400	2671420	73	28	6
R06-400	2671540	41	19	10
R07-400	2671648	41	21	21
R08-400	2671810	11	5	28
R09-400	2671934	3	2	29
R10-400	2672044	5	3	6

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SECTION 4. CONCLUSIONS AND RECOMMENDATIONS

The principal purpose of this report is to document the DSWA Phase I Transport and Dispersion Model Validation field test, which consisted of sets of puff releases measured over downwind distances of 200 to 1200 m. The Phase I test was a tripartite (U.S., U.K., Canada) effort. The British and Canadian participants collecting fast-response concentration data, and Aerospace Corporation used remote sensing to track the puffs, while DPG provided overall test management and meteorological support. Puff statistics from the TIPSJ3A PIDs, grouped into ensembles for relative diffusion analysis, are provided by Chandler (1997) and are available, along with the 2- and 8-m DPG micrometeorological data, on CD. The British UVIC data, also available on CD, are still in the process of being analyzed. Trial meteorological summaries are consolidated in this report. These and the remaining sonic data will be included on a second edition CD.

The Phase I trials series was successful in spite of problems with unstable weather conditions during the first half of the test. A total of 30 trials, 23 of which were of sufficient quality for inclusion in ensemble statistics, were generated during the test. This data set constitutes the largest and best documented puff data set produced to date for dispersion model validation purposes and the only atmospheric data set presently suitable for validating the probabilistic prediction capability of SCIPUFF and subsequent next generation puff dispersion models.

A unique aspect of the Phase I test was the use of remote imagery by Aerospace Corporation to document the vertical development of puffs after release. Full analysis of the puff imagery is yet to be completed, but basic statistics from the vertical position of plume centroids crossing the primary sampling line are included in this report. The available imagery indicates that the centers of mass of dispersing puffs often rise above the surface, forming a characteristic comma shape with the tail extending from the rear of the puff towards the surface. In these cases, the surface-based sampling lines detected only the wispy tails of the dispersing puffs. Analysis of the imagery and the correlation of puff positions with meteorological data are important follow-on tasks.

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SECTION 5. APPENDICES

APPENDIX A. METEOROLOGICAL MEASUREMENTS

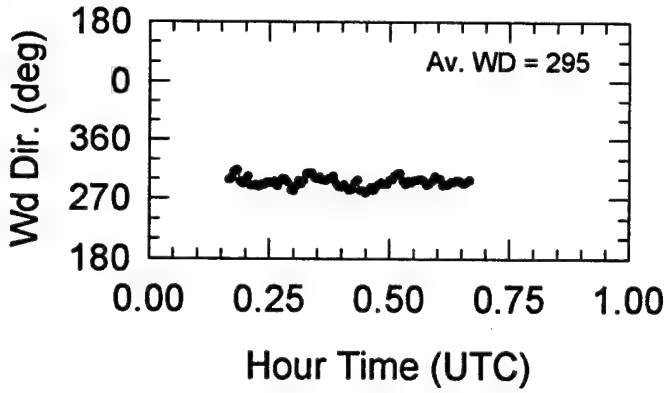
A.1 2-METER WIND PLOTS

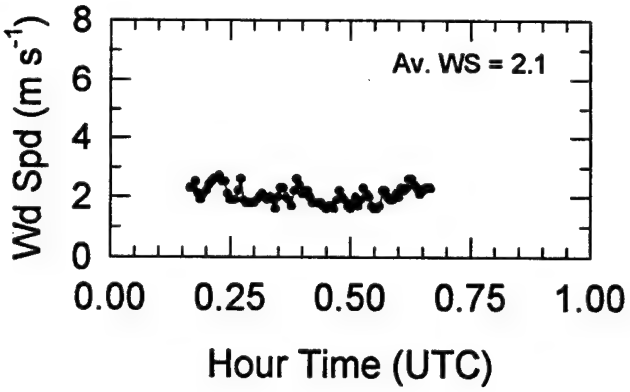
Tripod-mounted wind sets (R. M. Young Model 05103 Aerovane) were positioned at a height of 2 m AGL around the test area to provide real-time wind monitoring for test control. The three 2-m mast locations were: (1) the surface weather observation site, 1000 m southwest of the test grid center on Goodyear Road (see Figure 2); (2) 50 m west of the test grid center on Photo Pad 11; and, (3) 1000 m north of the test grid center. Appendix A.1 contains plots of 1-min averaged 2-m wind speeds and directions collected during each trial. These plots also include trial averaged wind directions and speeds.

TRIAL 2541800

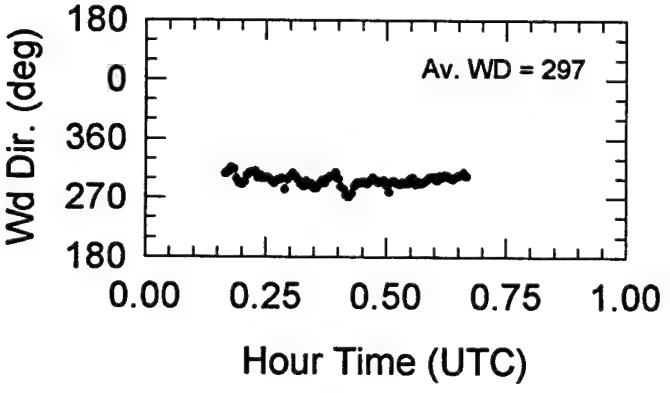
2-m Mast Wind Data

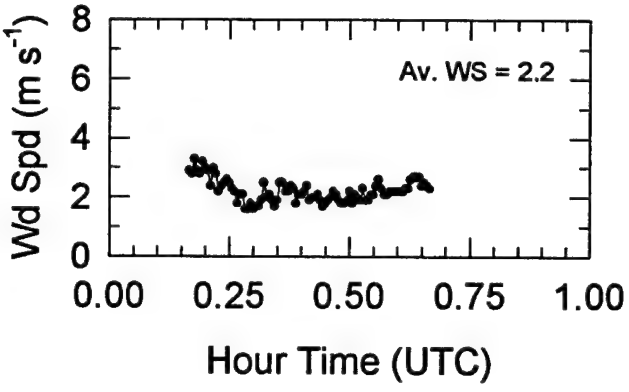
Met Observation Site



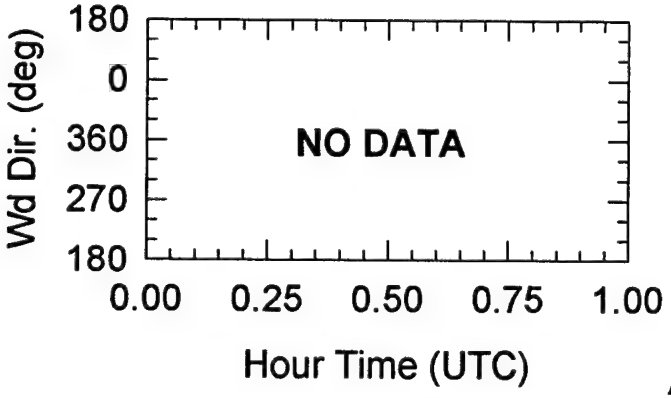


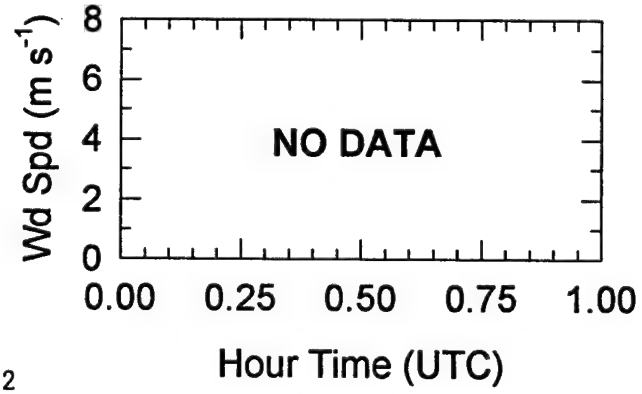
CP Site





1 Km Site

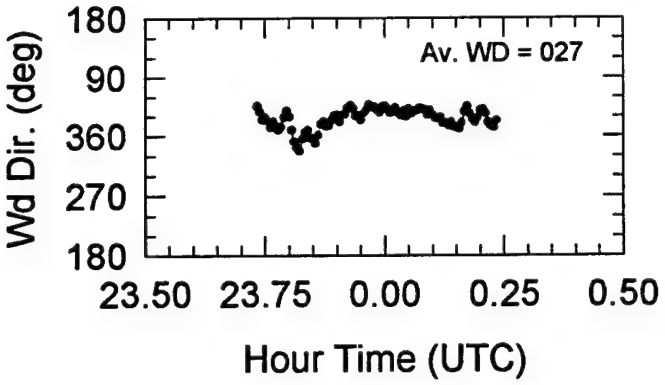


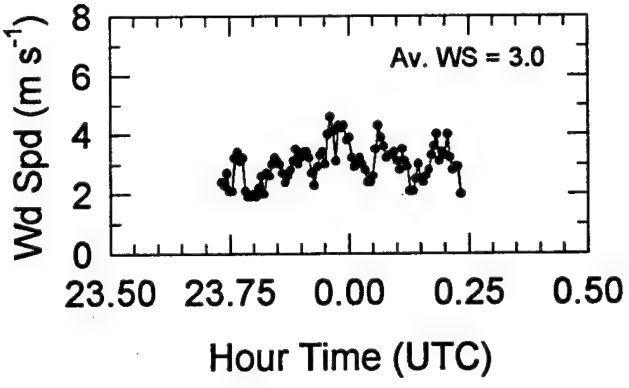


TRIAL 2551730

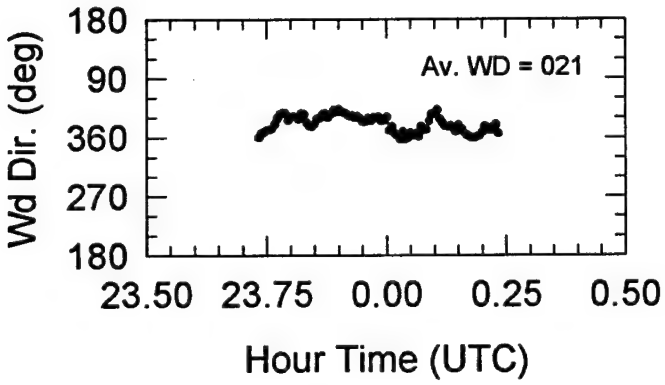
2-m Mast Wind Data

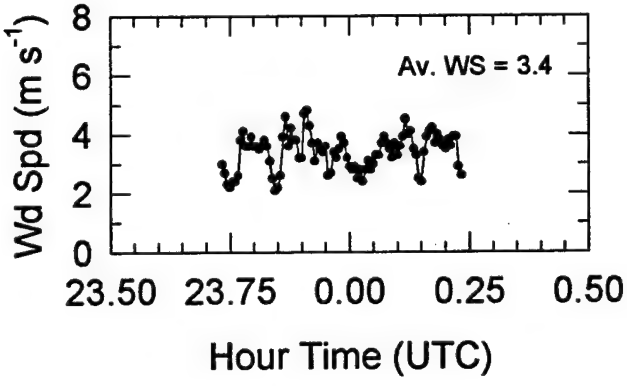
Met Observation Site



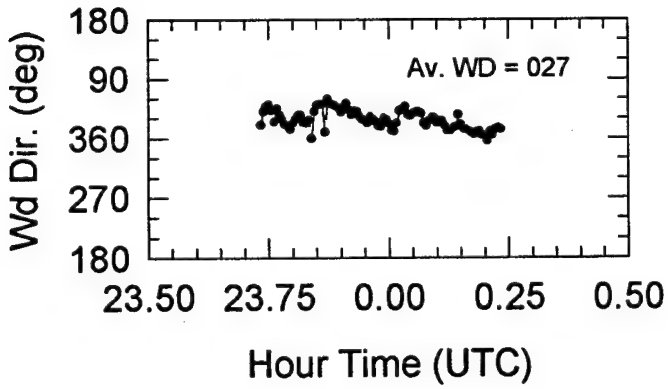


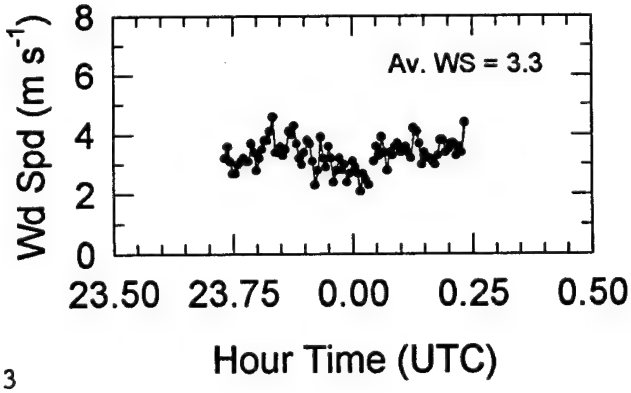
CP Site





1 Km Site

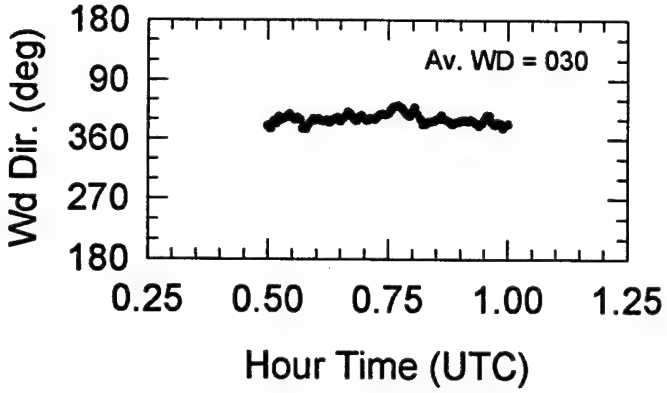


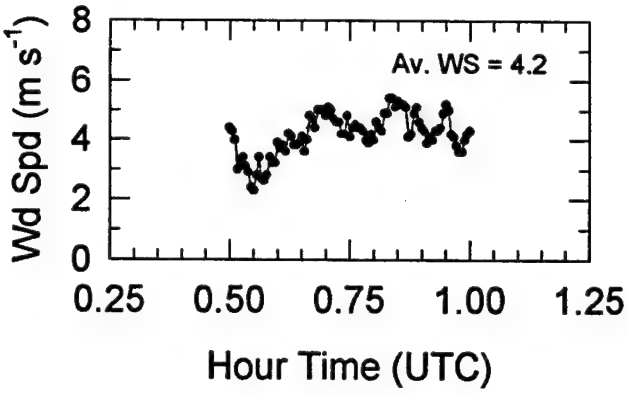


TRIAL 2551830

2-m Mast Wind Data

Met Observation Site





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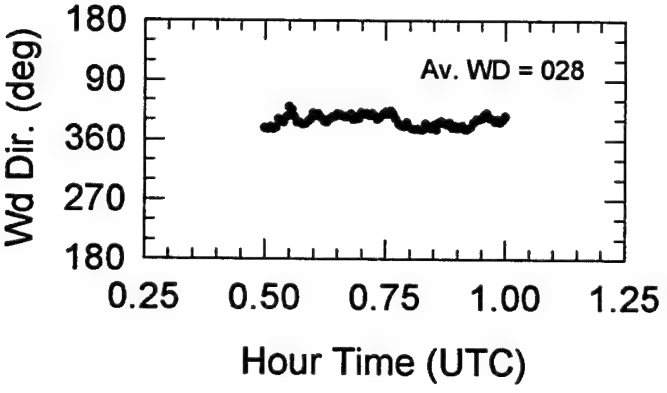

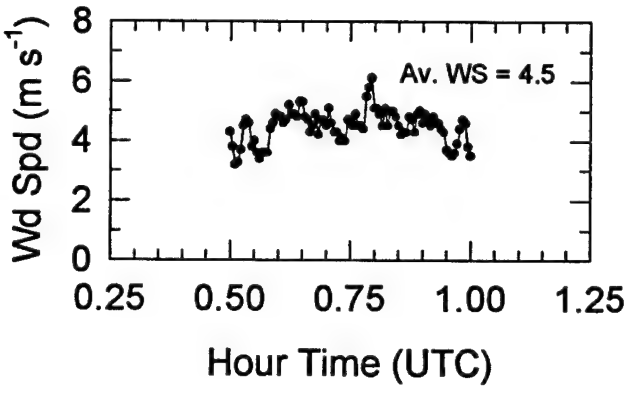

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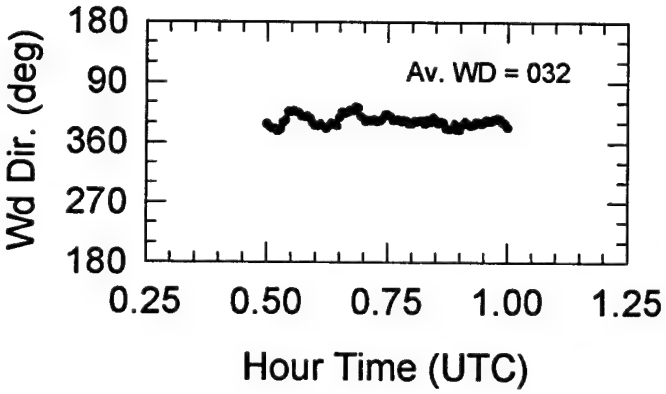
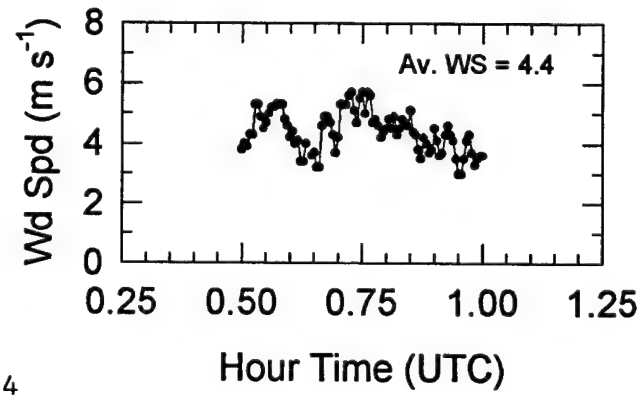
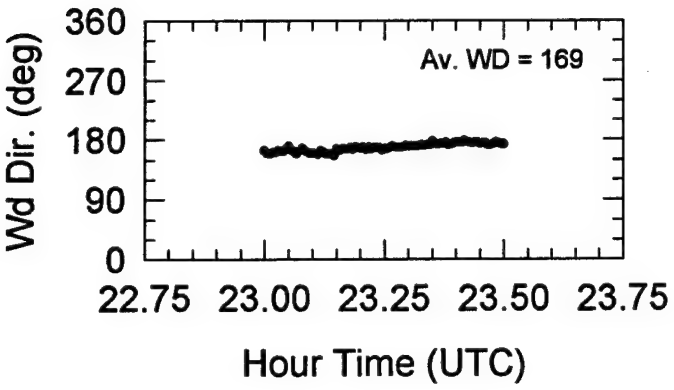


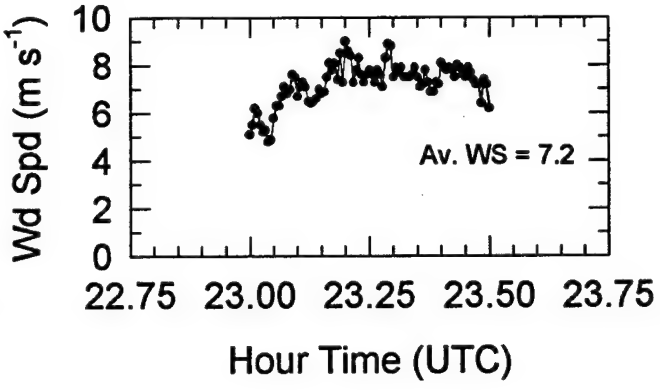


TRIAL 2561700

2-m Mast Wind Data

Met Observation Site





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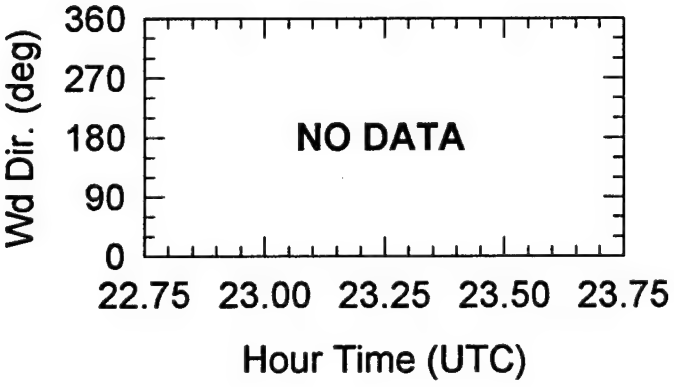

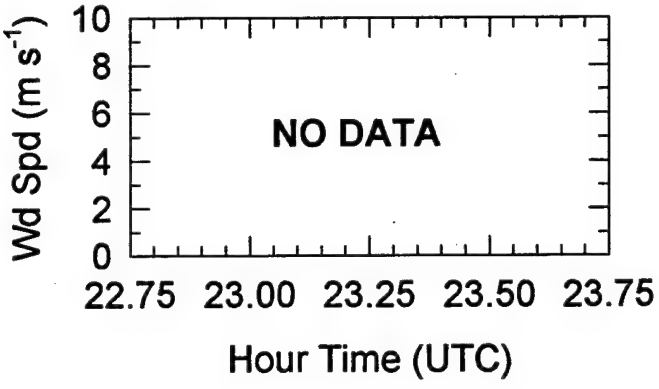

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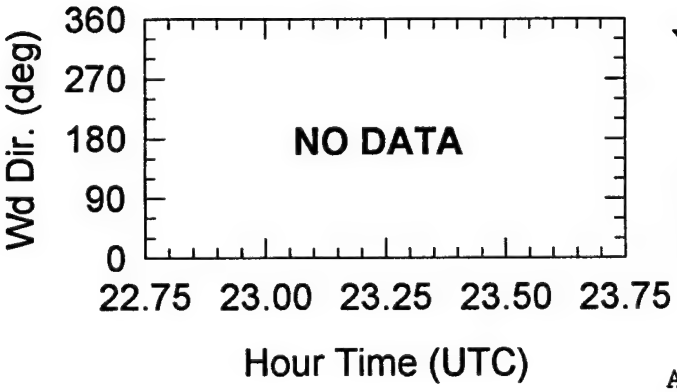
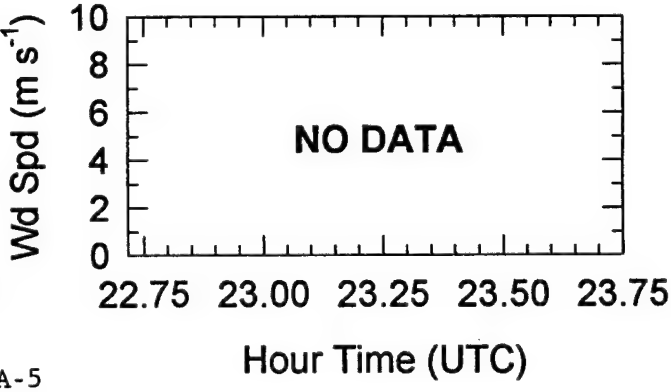
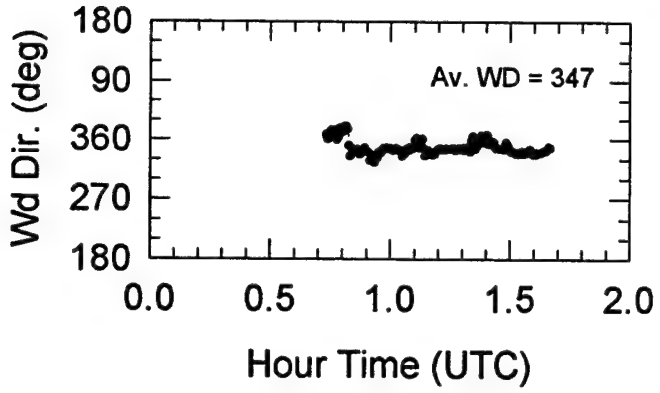


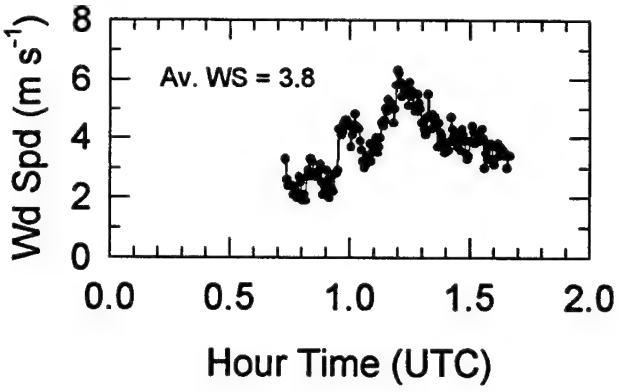


TRIAL 2611844

2-m Mast Wind Data

Met Observation Site





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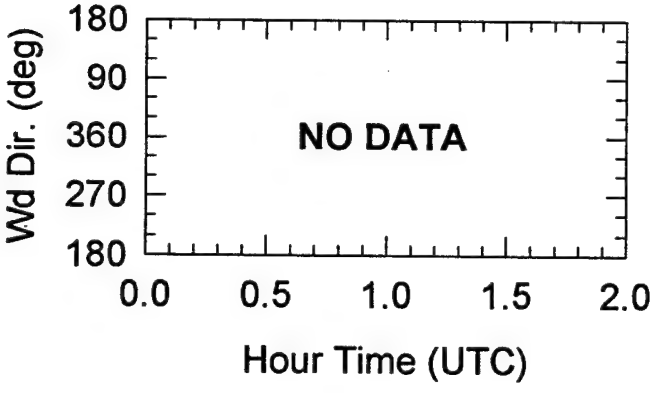

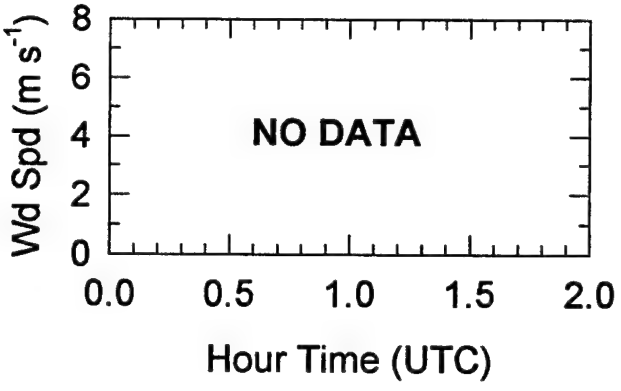

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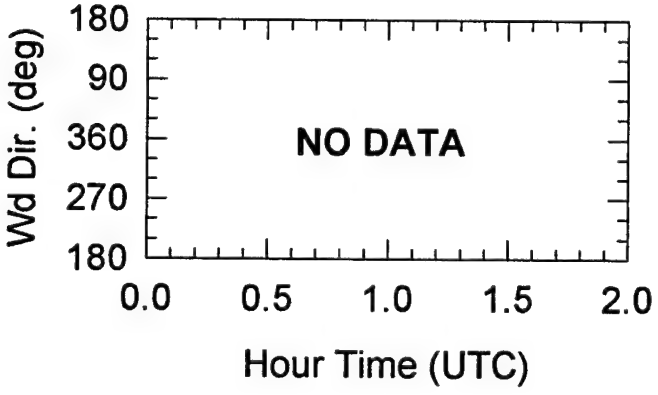
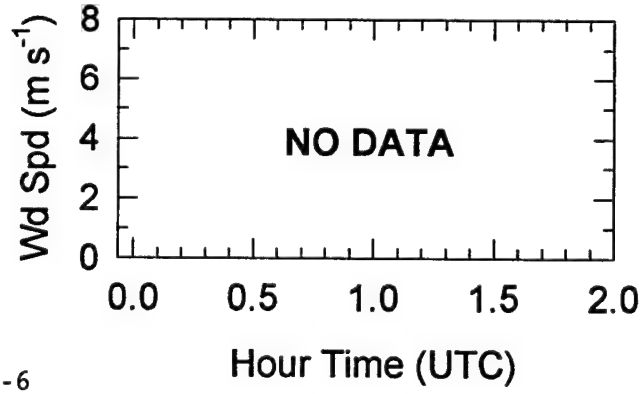
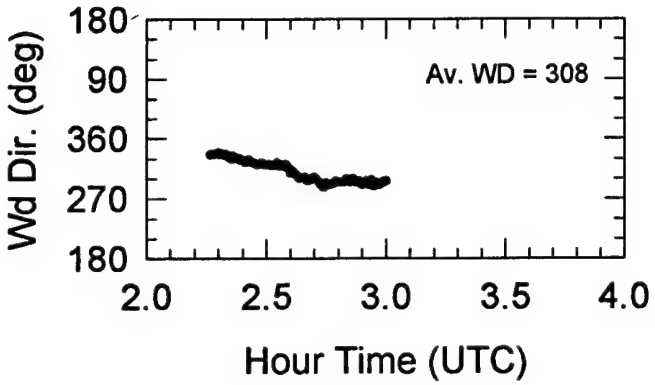


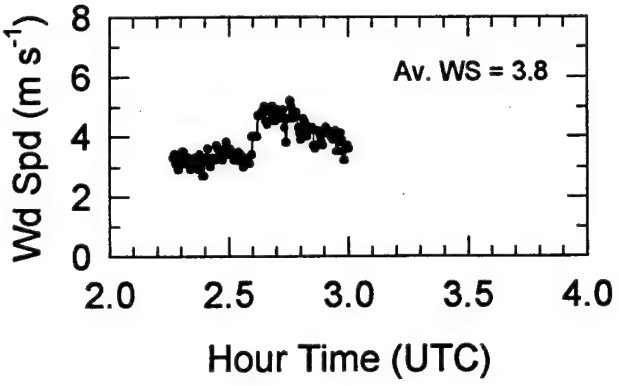


TRIAL 2612016

2-m Mast Wind Data

Met Observation Site





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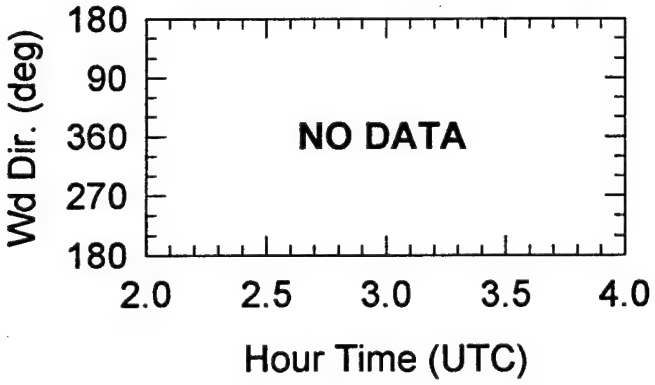

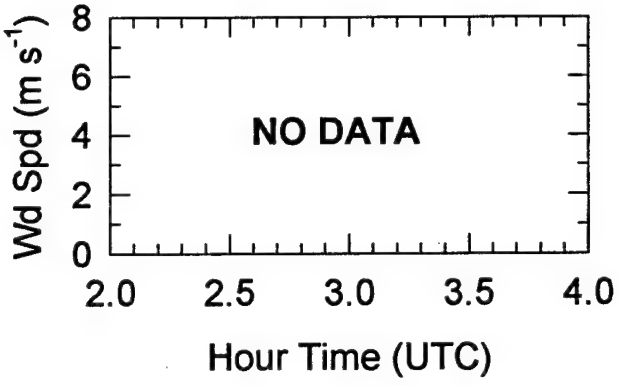

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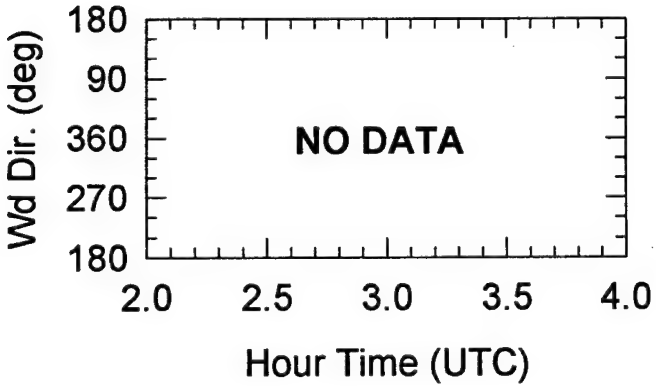
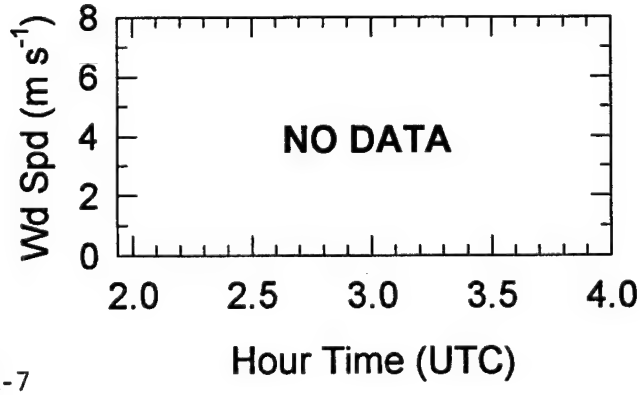
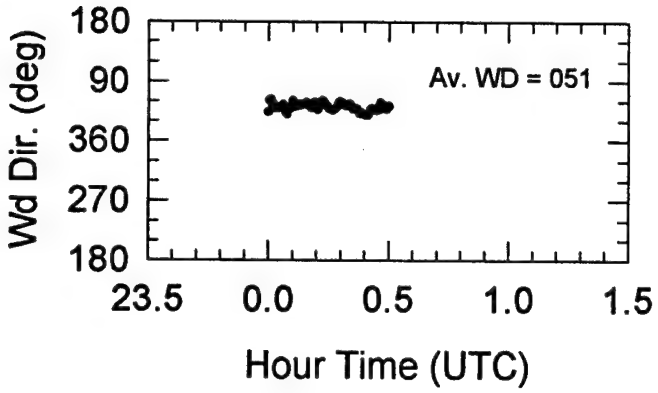


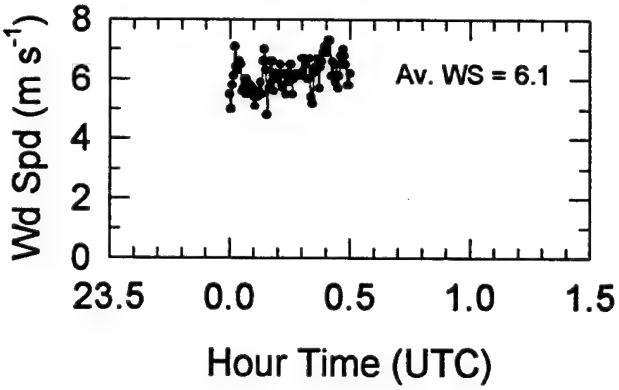


TRIAL 2631800

2-m Mast Wind Data

Met Observation Site





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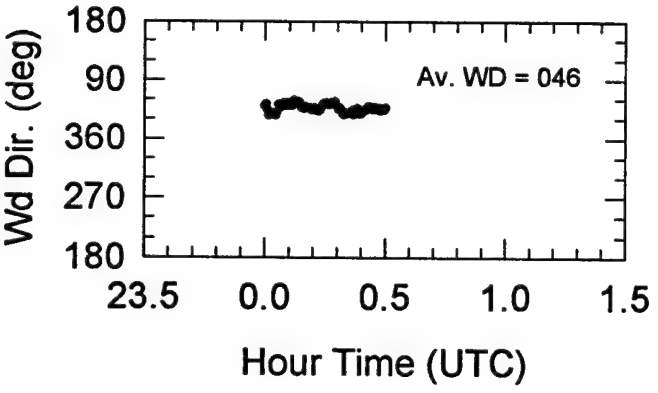

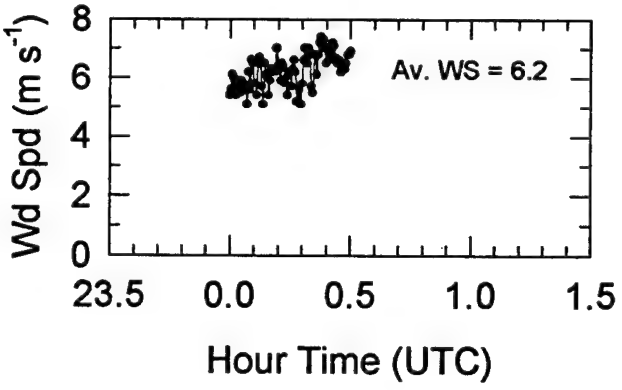

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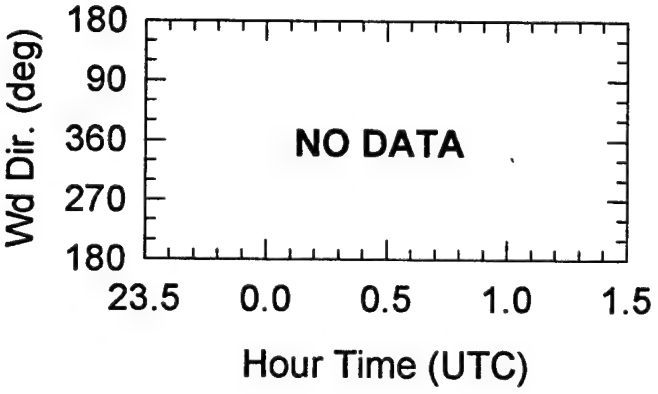
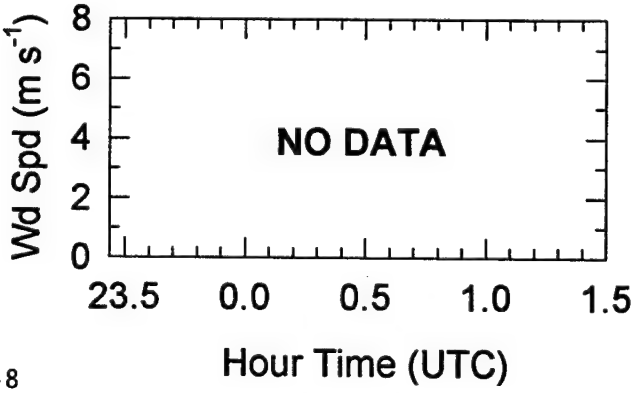
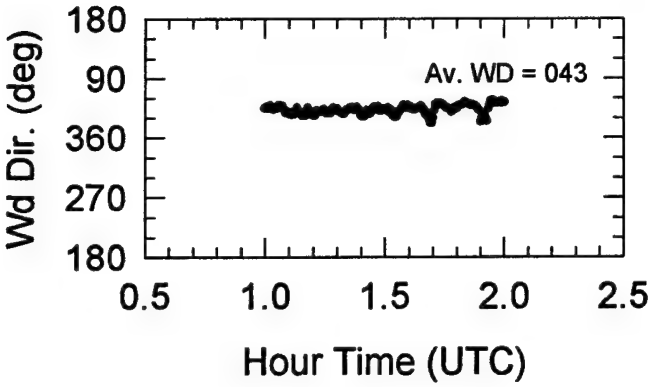


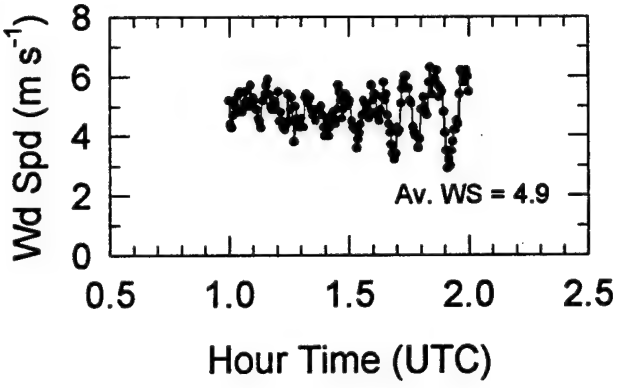


TRIAL 2631900

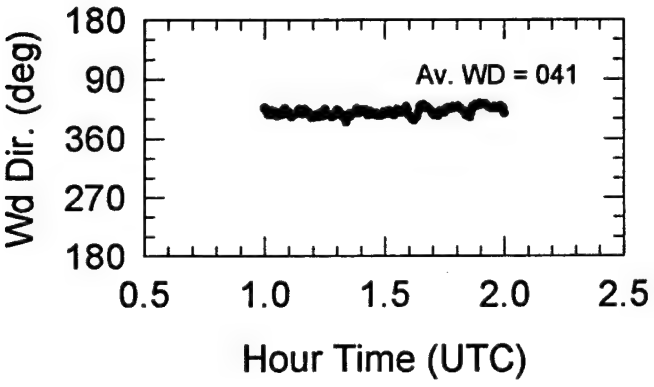
2-m Mast Wind Data

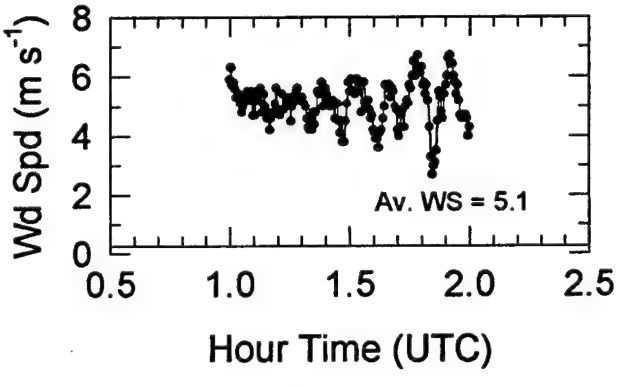
Met Observation Site





CP Site





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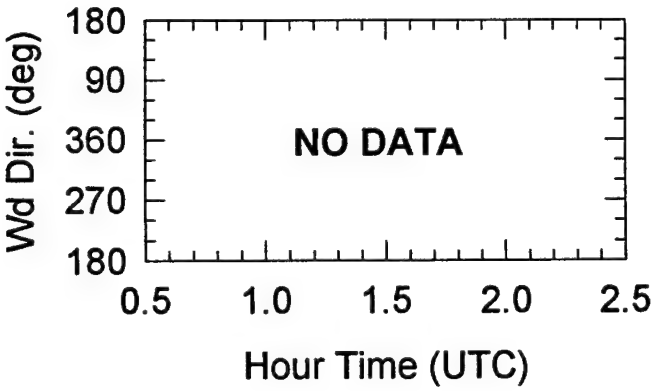
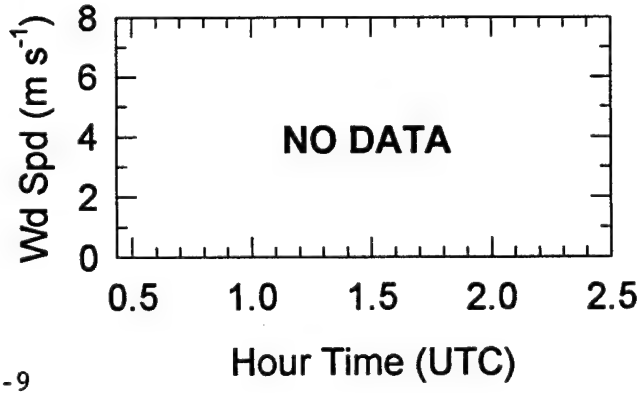
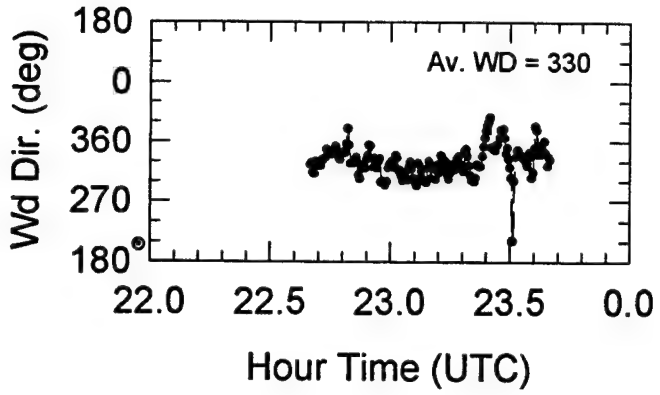


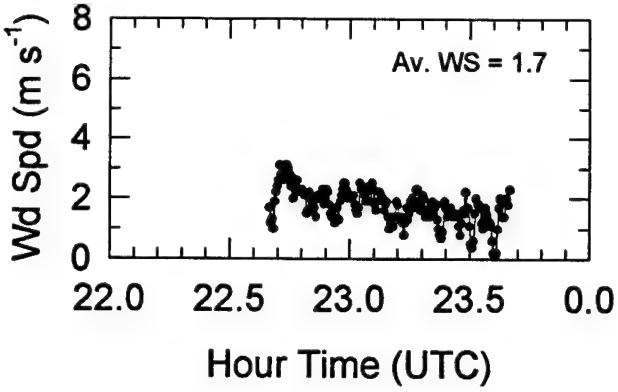


TRIAL 2651640

2-m Mast Wind Data

Met Observation Site





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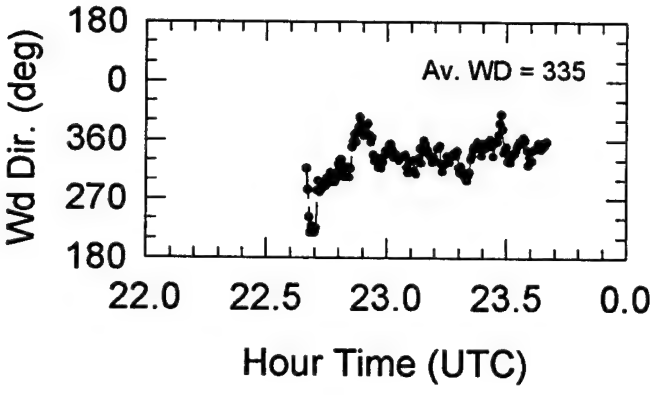

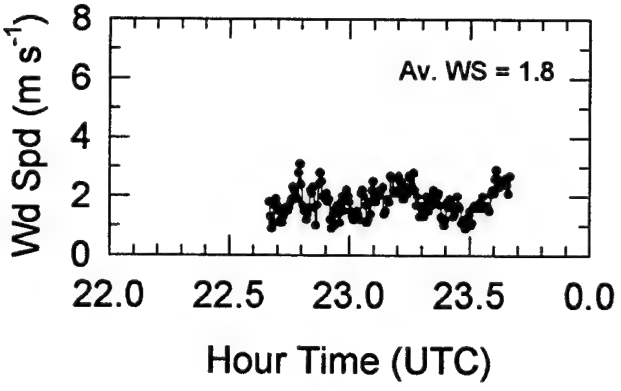

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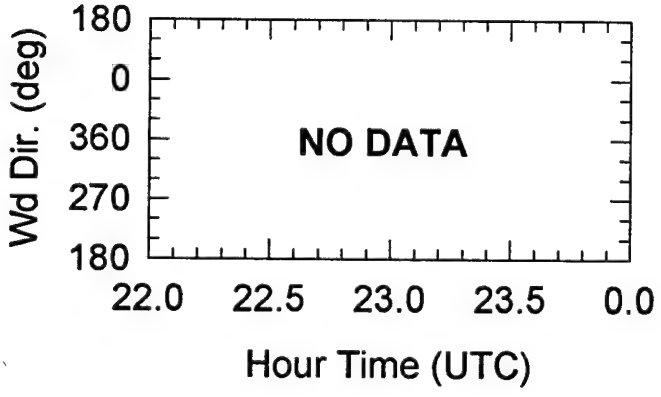
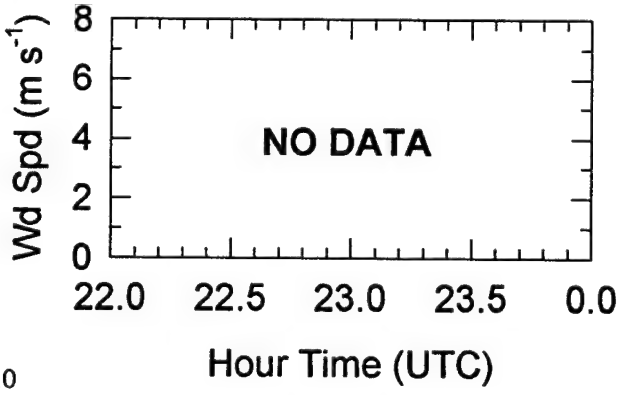
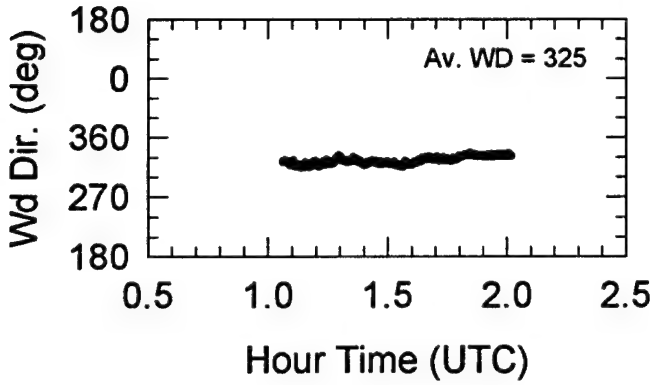


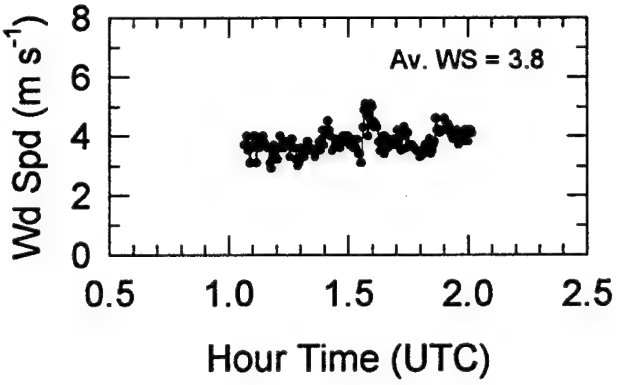


TRIAL 2651904

2-m Mast Wind Data

Met Observation Site





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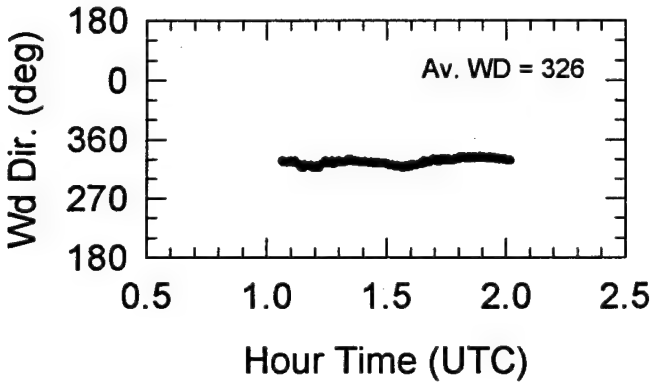

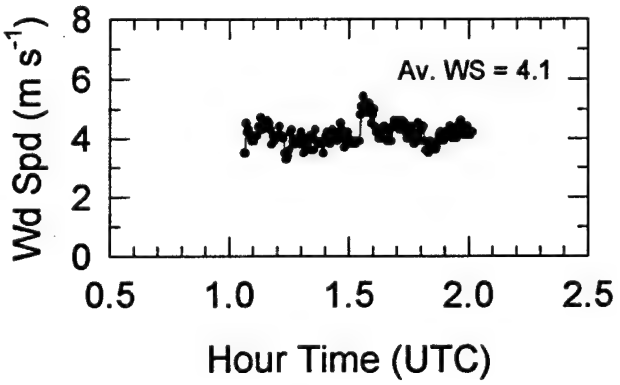

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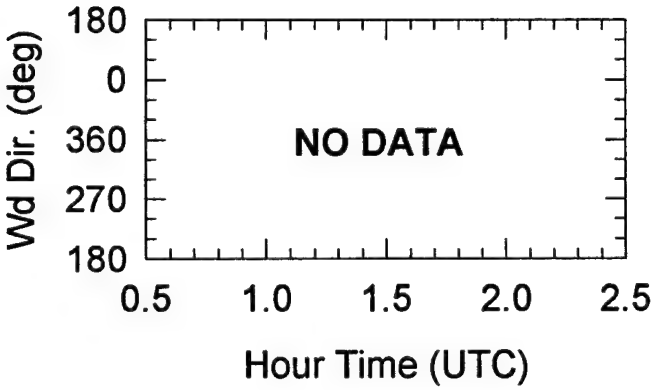
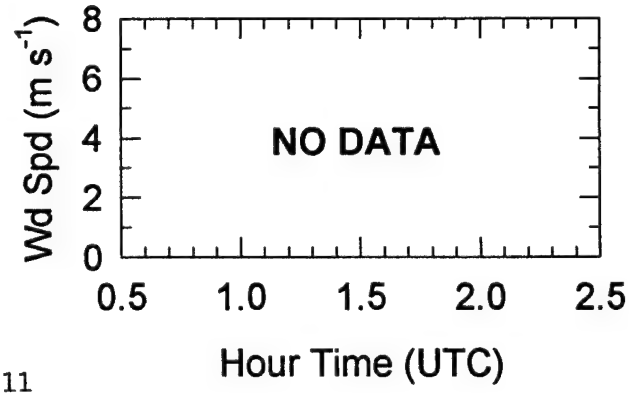
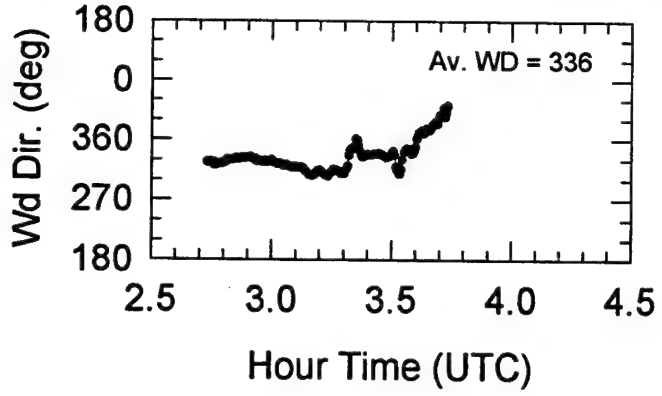


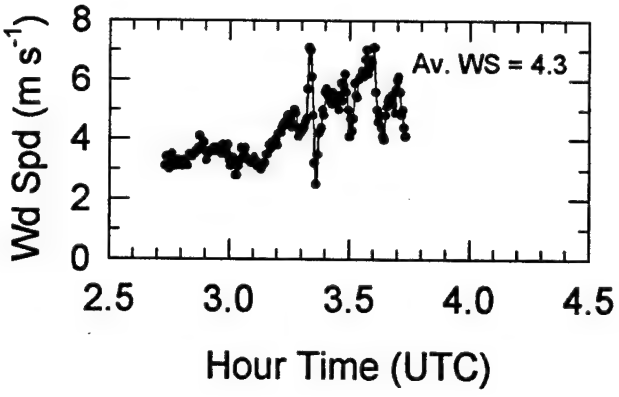


TRIAL 2652044

2-m Mast Wind Data

Met Observation Site





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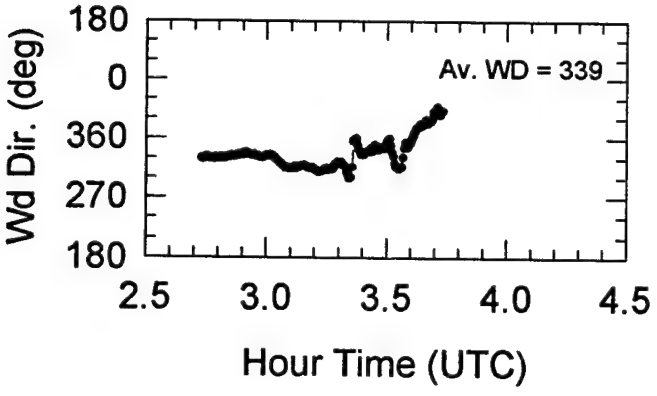
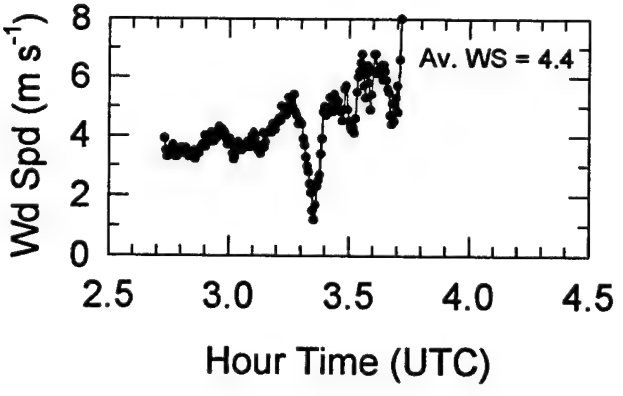
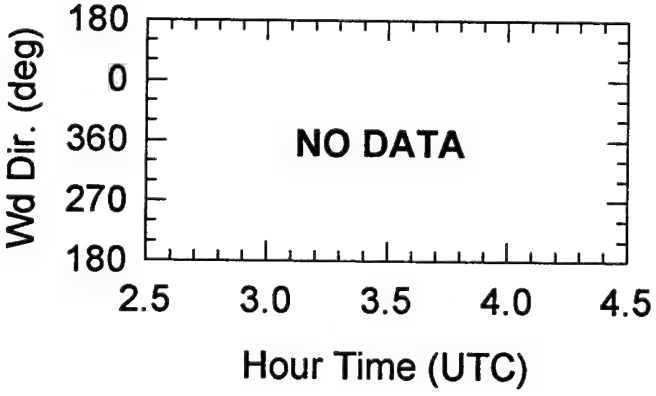
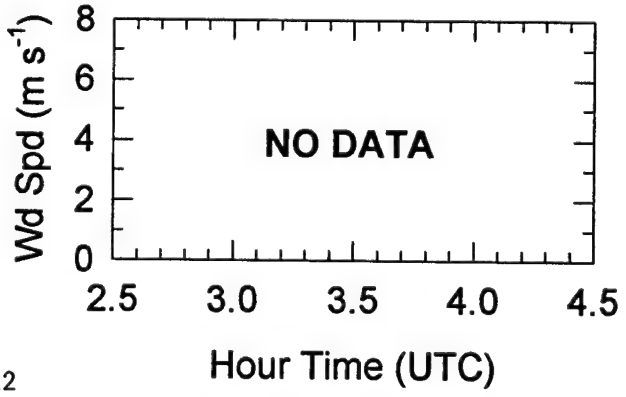




1 Km Site

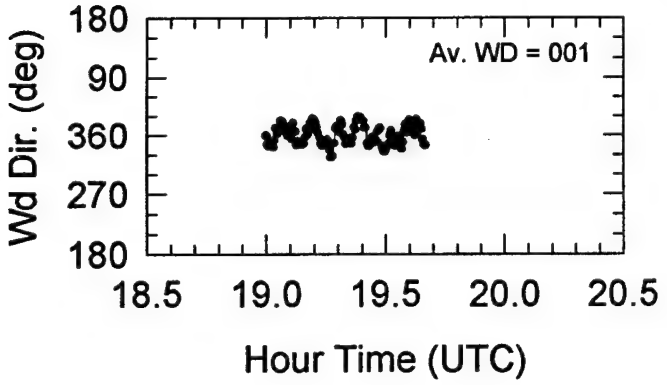


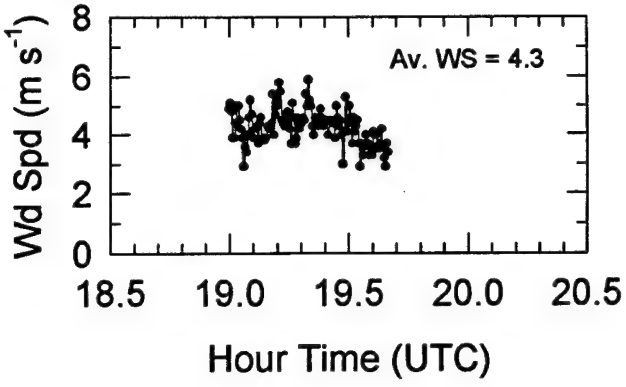


TRIAL 2671300

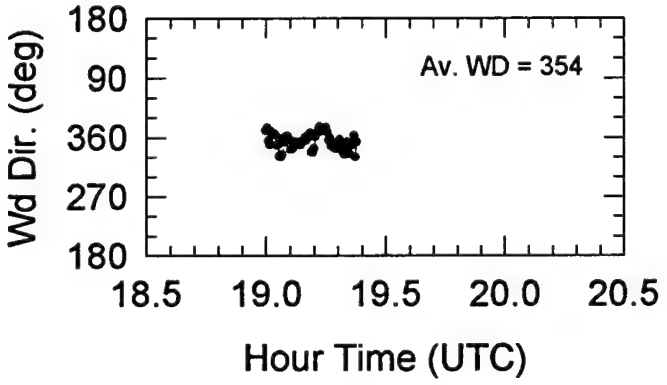
2-m Mast Wind Data

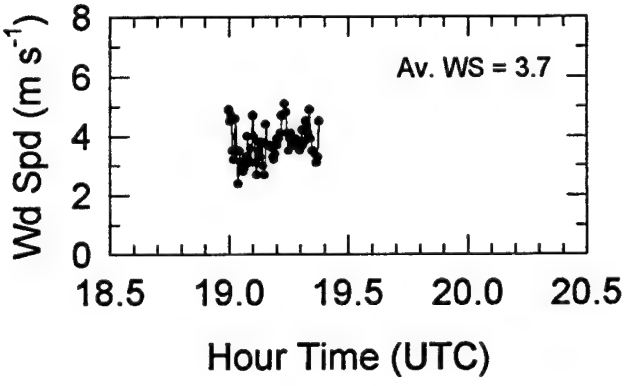
Met Observation Site



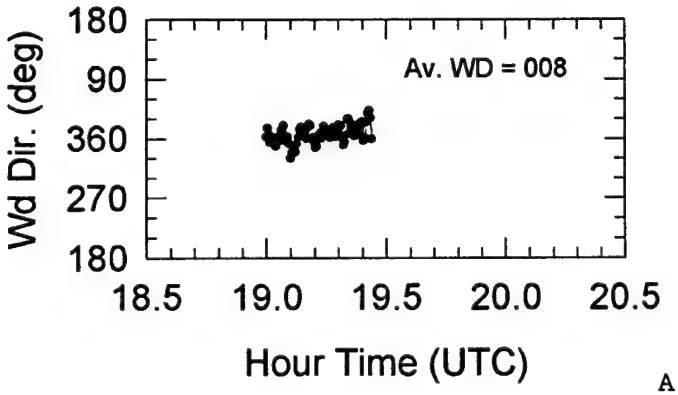


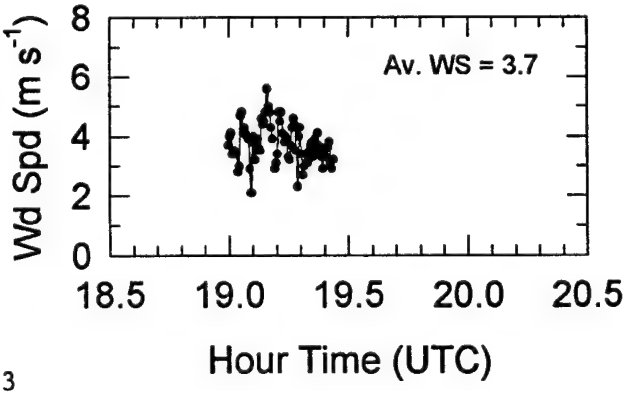
CP Site





1 Km Site

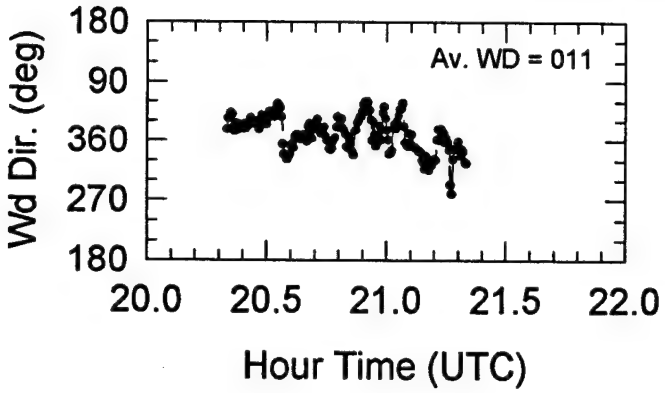


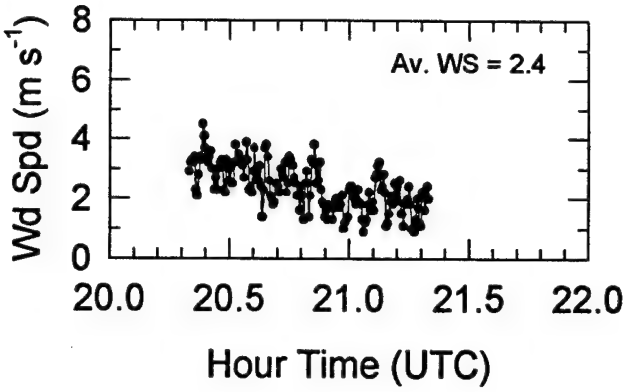


TRIAL 2671420

2-m Mast Wind Data

Met Observation Site





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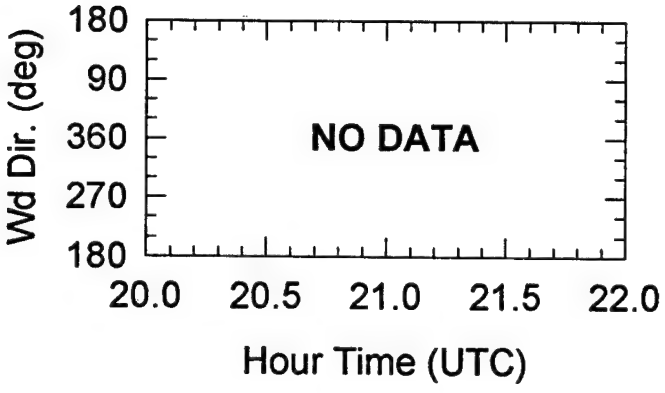

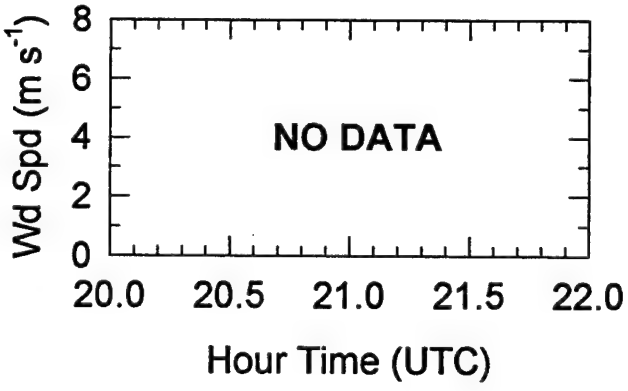

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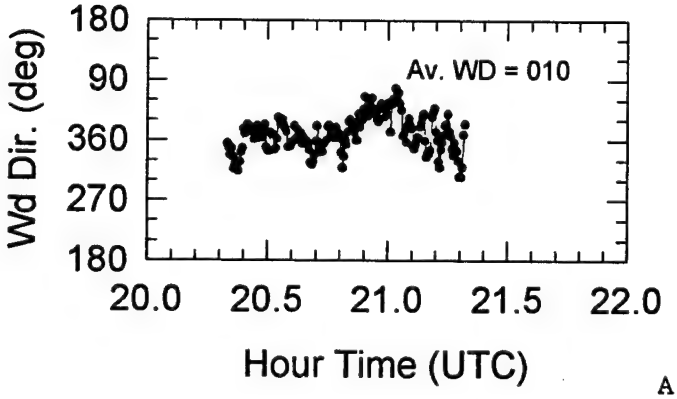
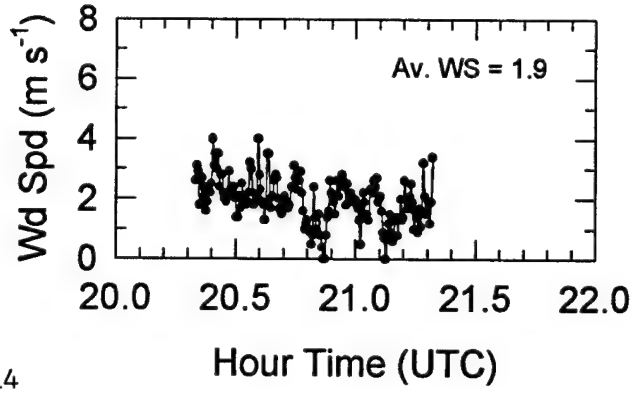
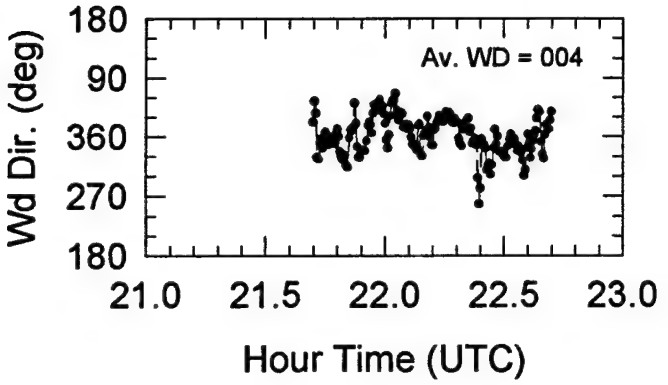


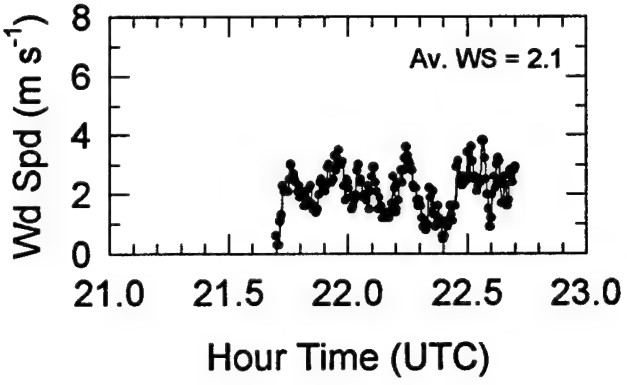


TRIAL 2671540

2-m Mast Wind Data

Met Observation Site





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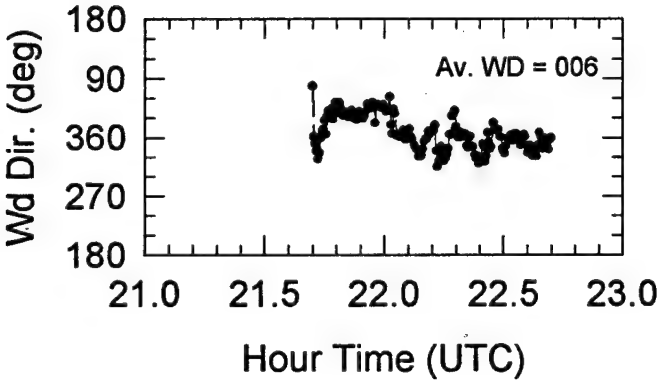

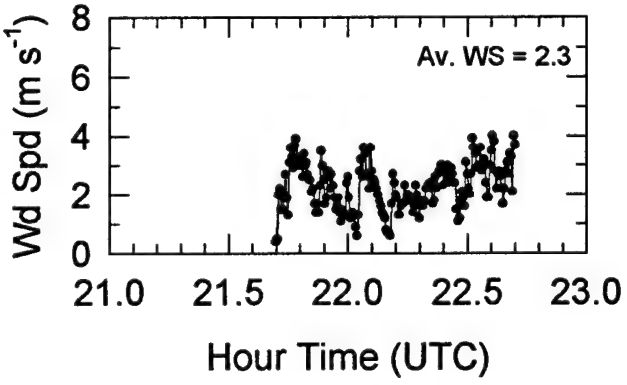

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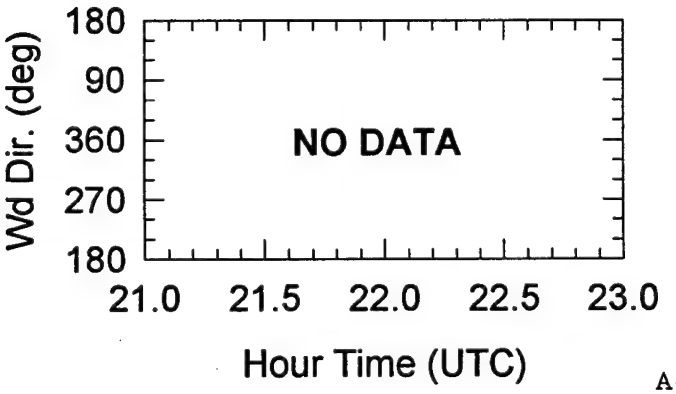
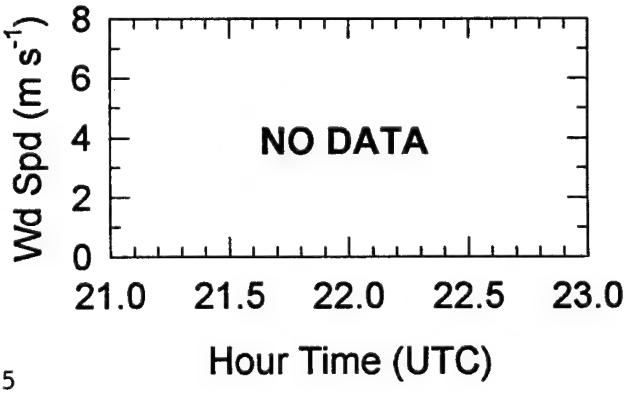
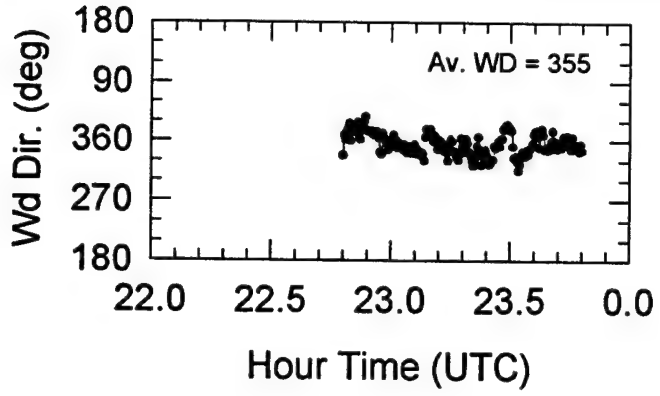


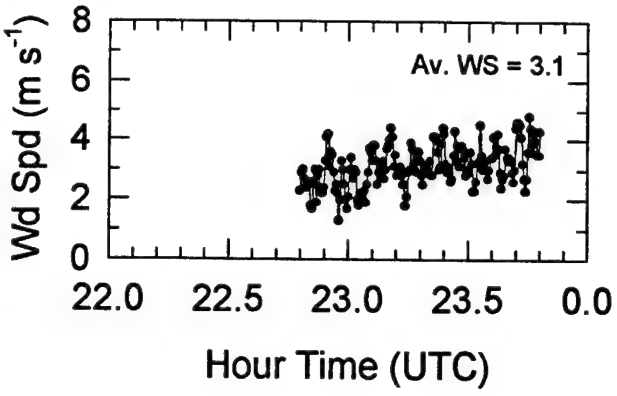


TRIAL 2671648

2-m Mast Wind Data

Met Observation Site





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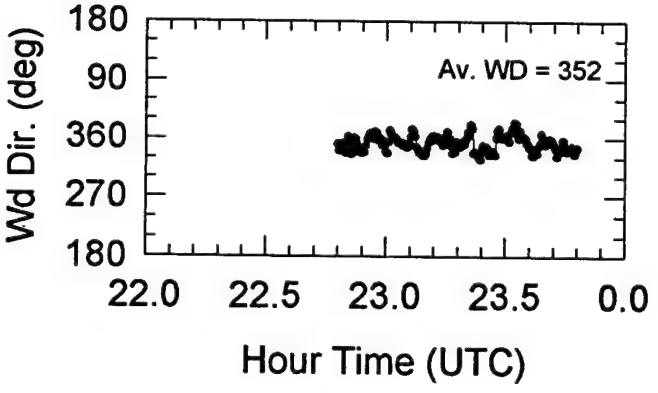

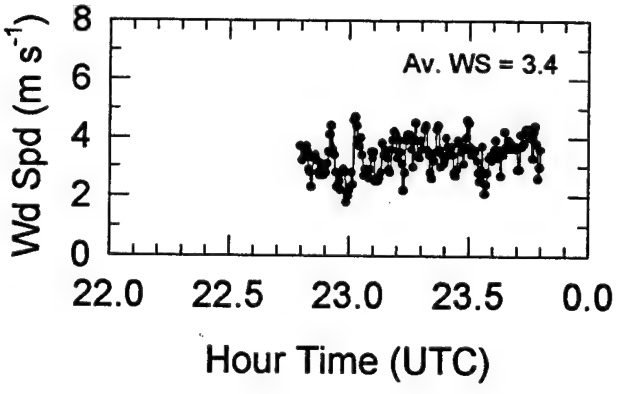

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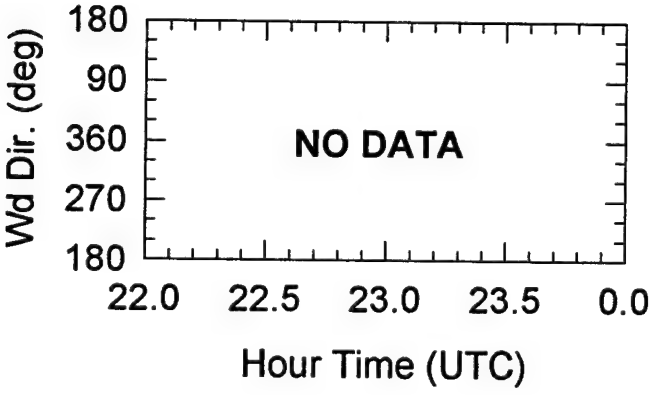
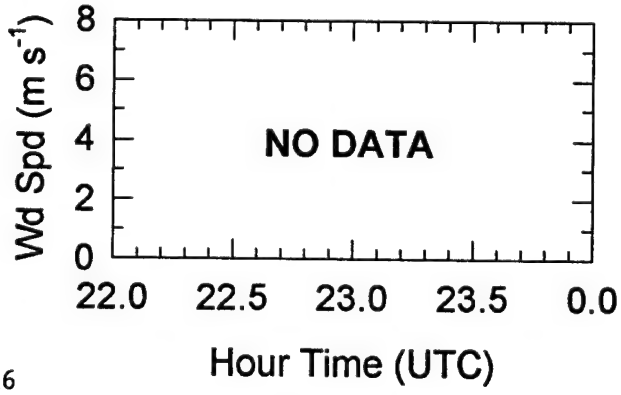
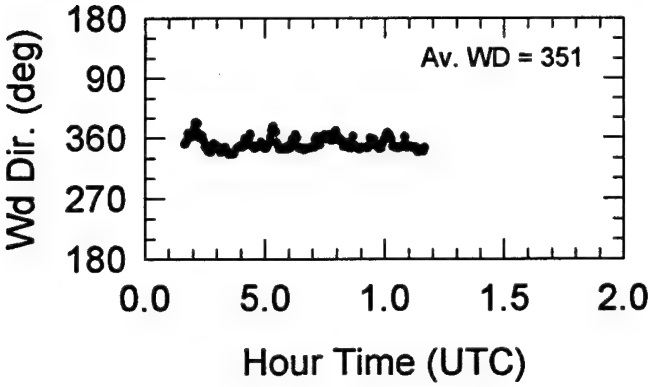


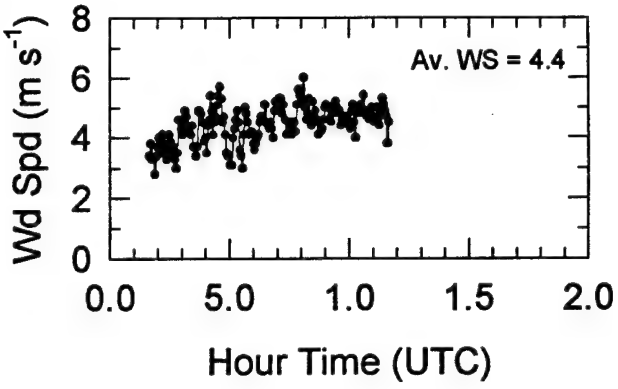


TRIAL 2671810

2-m Mast Wind Data

Met Observation Site





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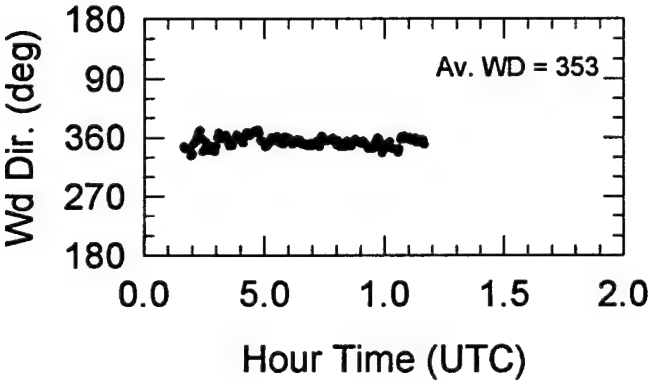

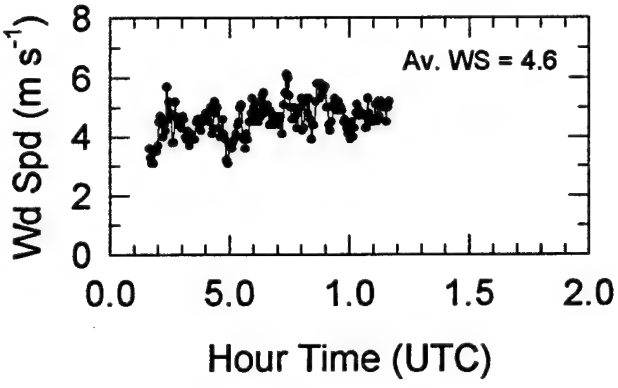

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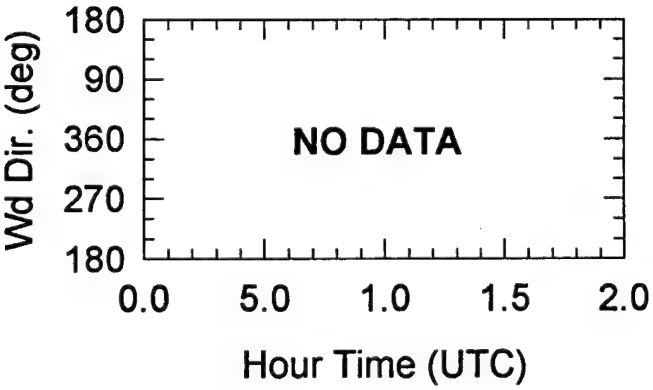
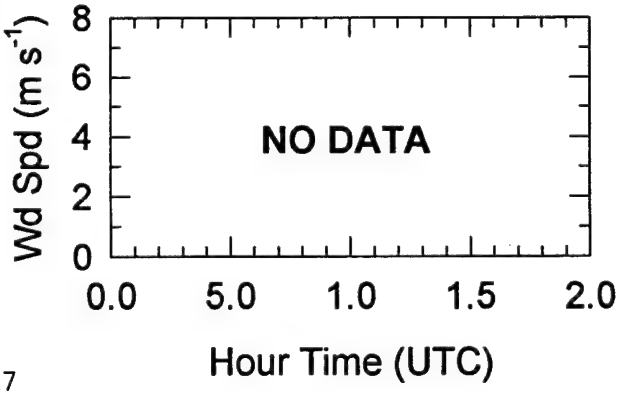
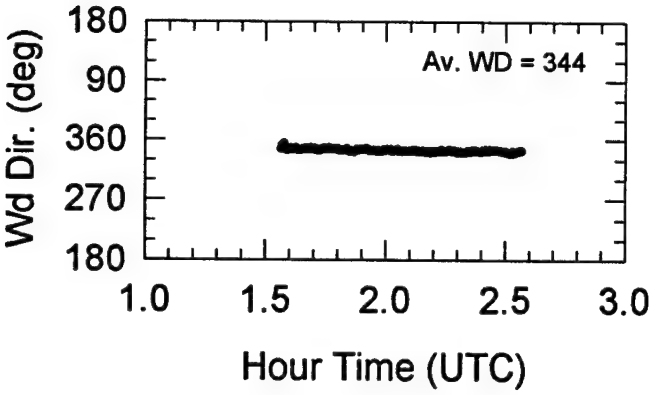


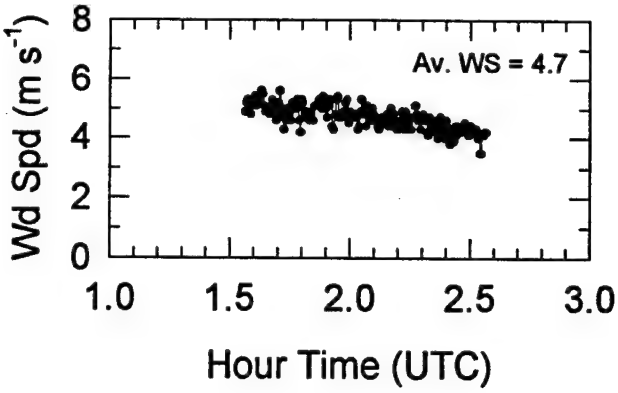


TRIAL 2671934

2-m Mast Wind Data

Met Observation Site





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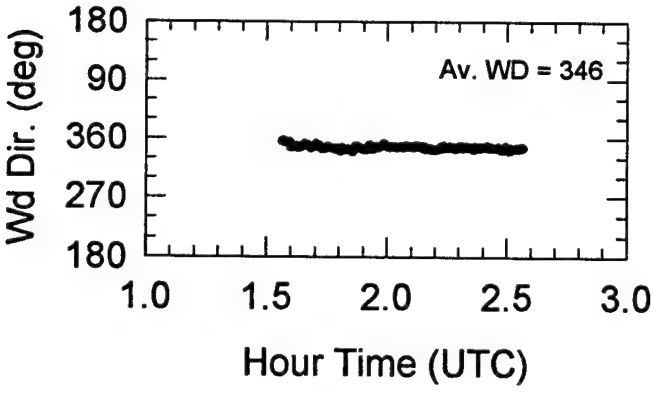

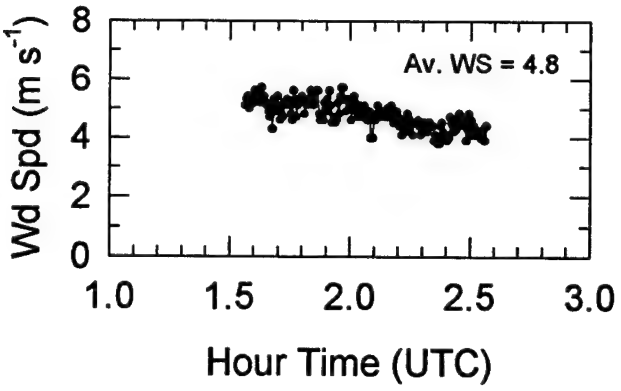

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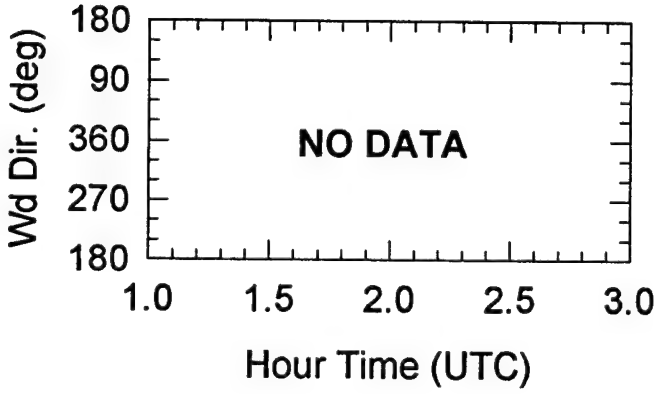
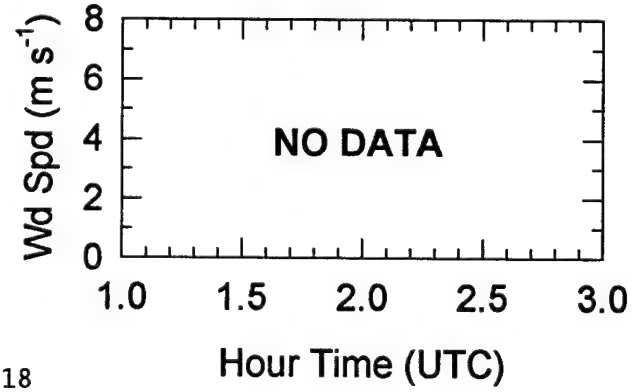
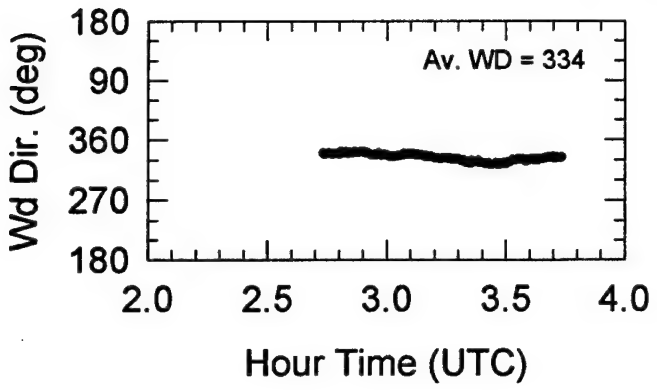


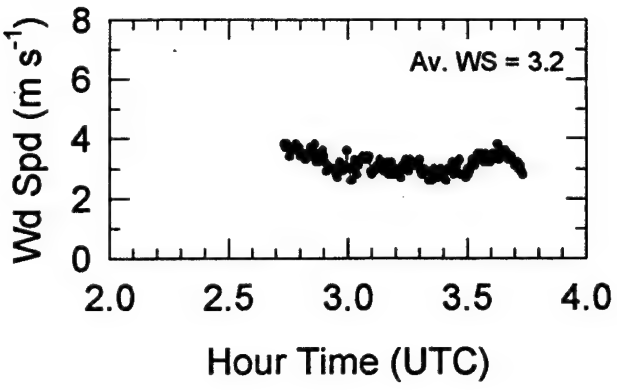


TRIAL 2672044

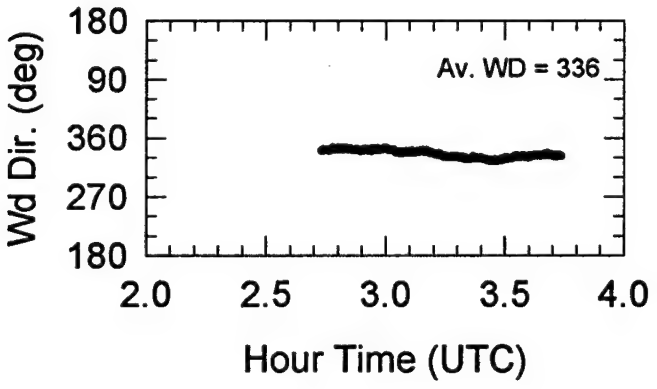
2-m Mast Wind Data

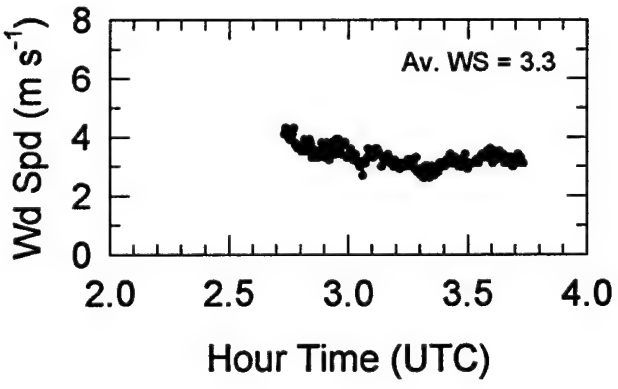
Met Observation Site





CP Site





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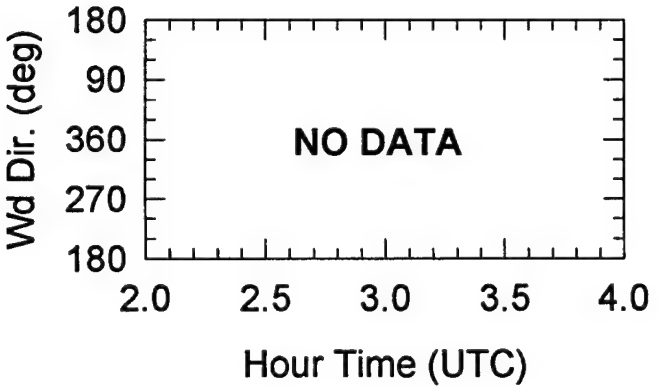
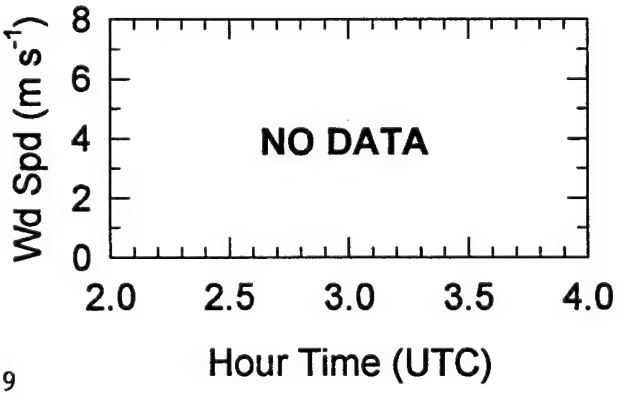
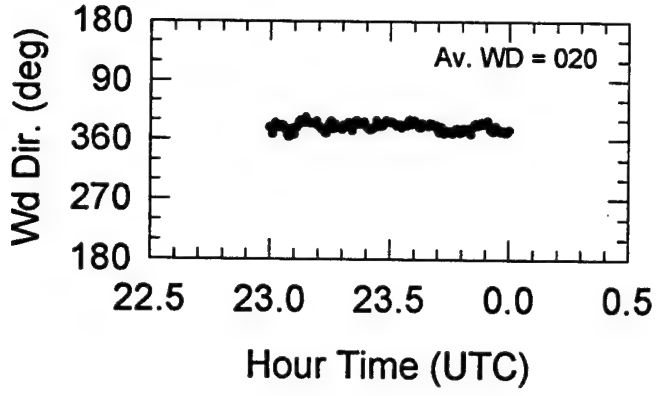


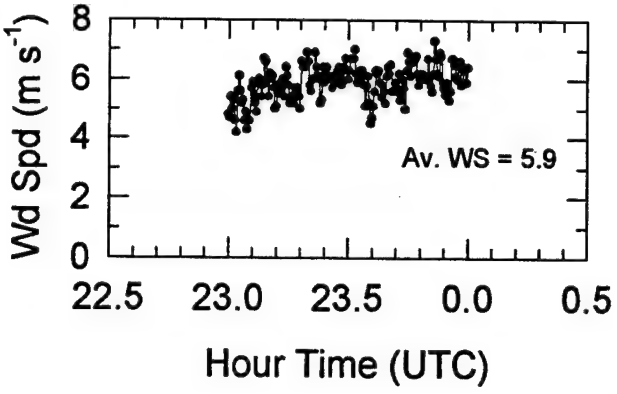


TRIAL 2681700

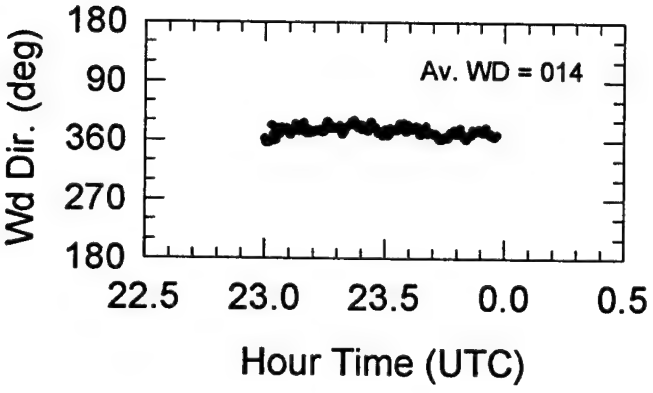
2-m Mast Wind Data

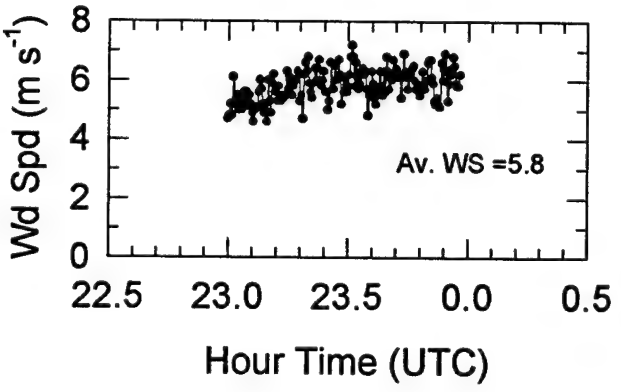
Met Observation Site





CP Site





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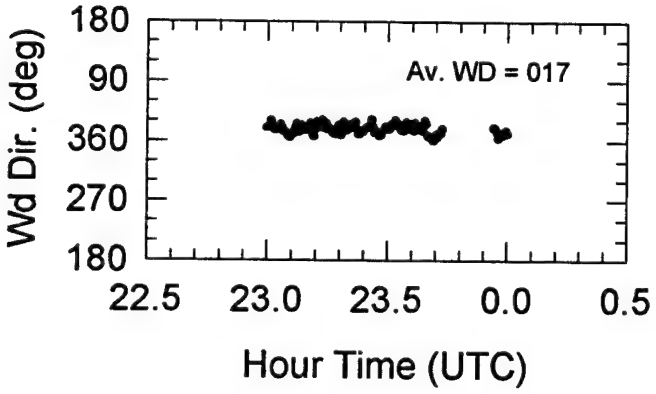
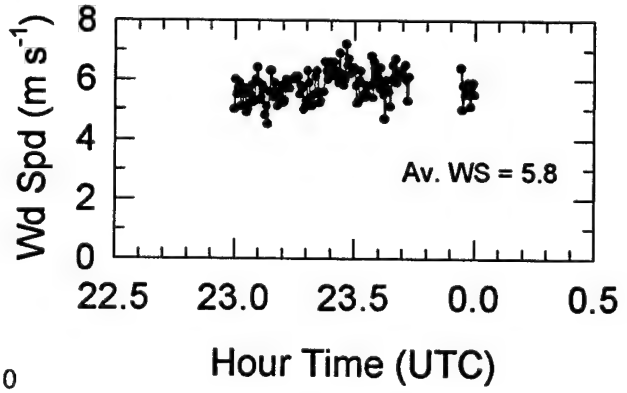
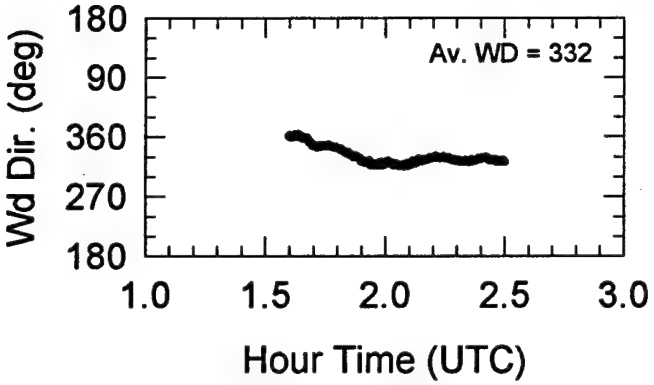


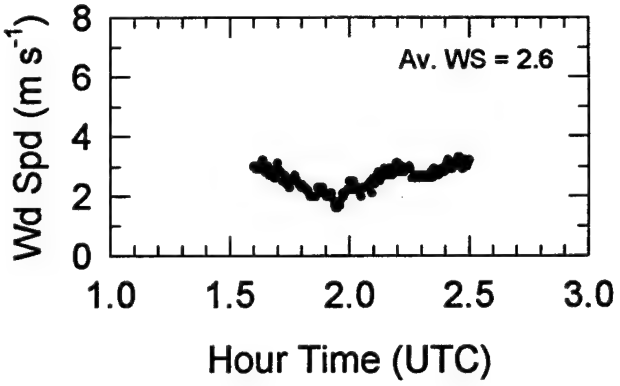


TRIAL 2681936

2-m Mast Wind Data

Met Observation Site





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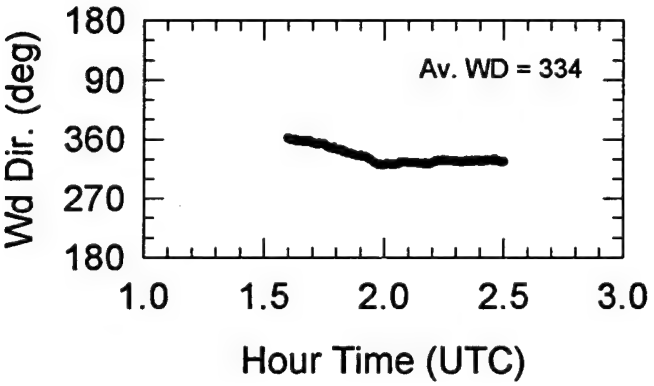

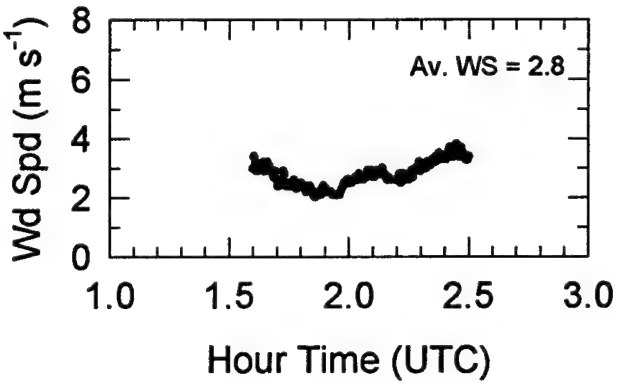

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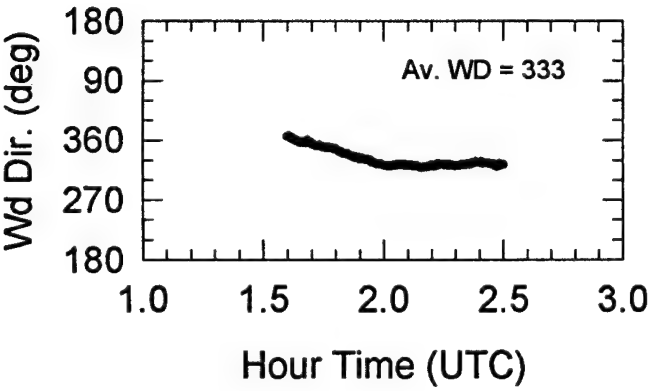
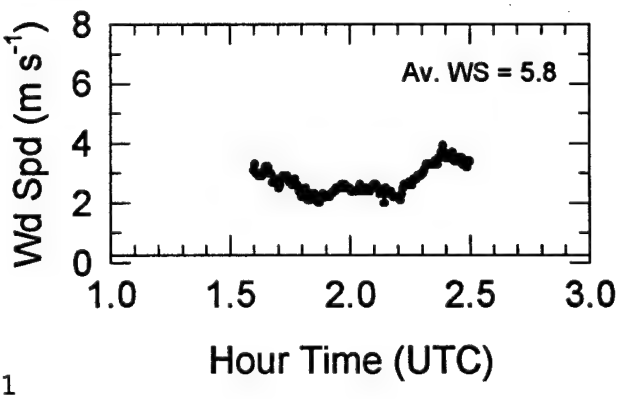
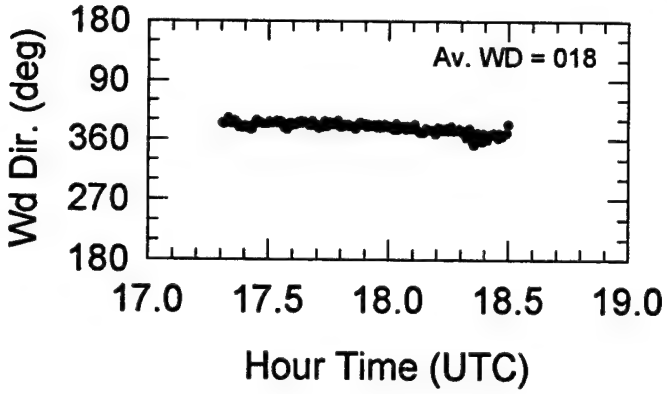


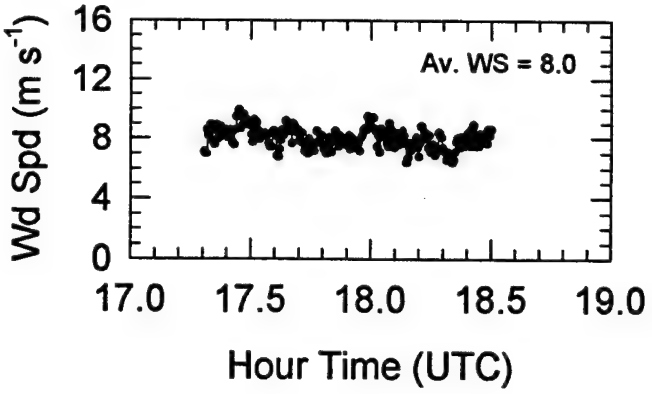


TRIAL 2691105

2-m Mast Wind Data

Met Observation Site





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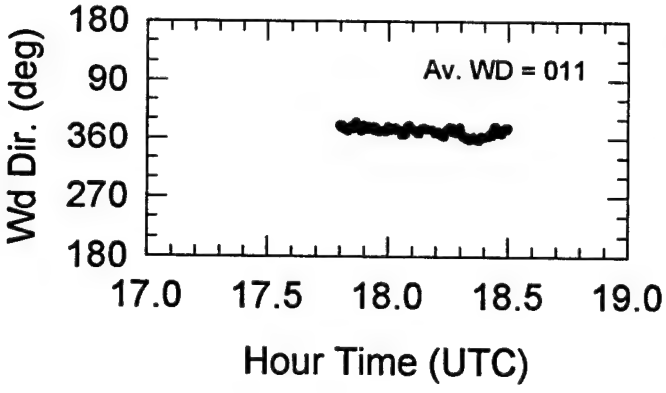
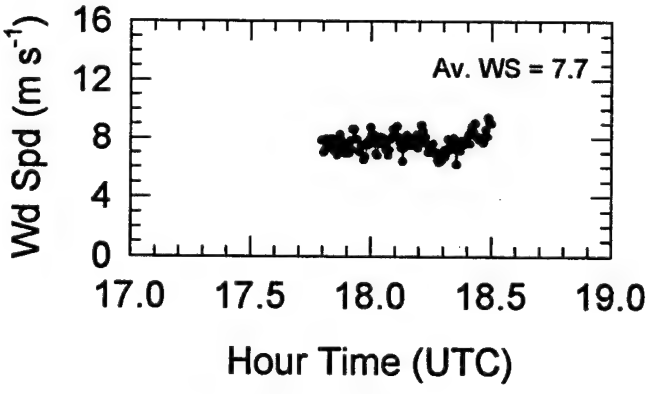
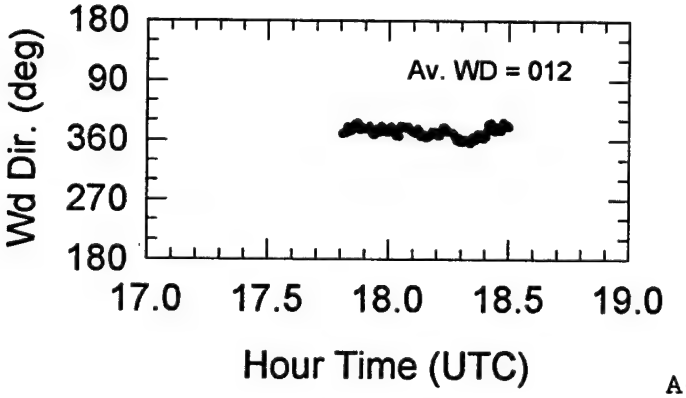
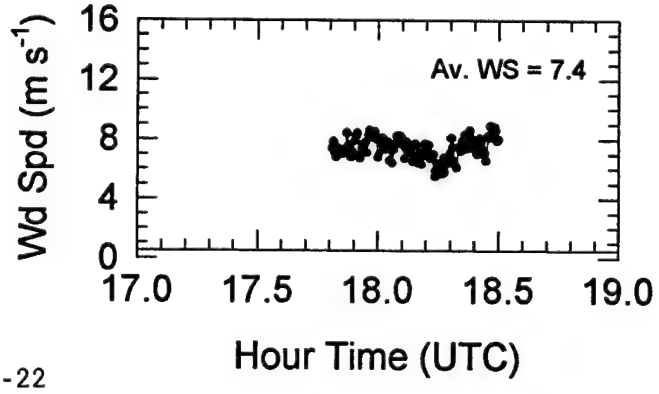




1 Km Site

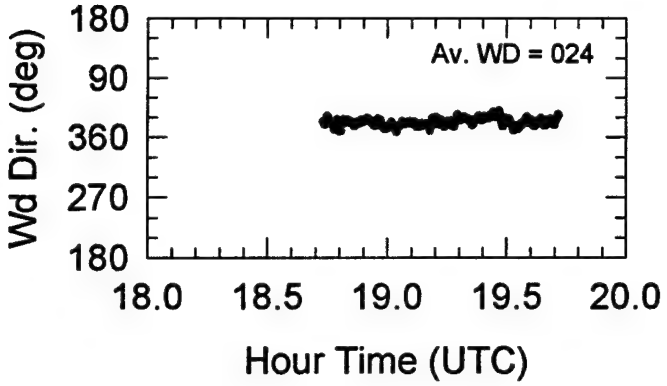


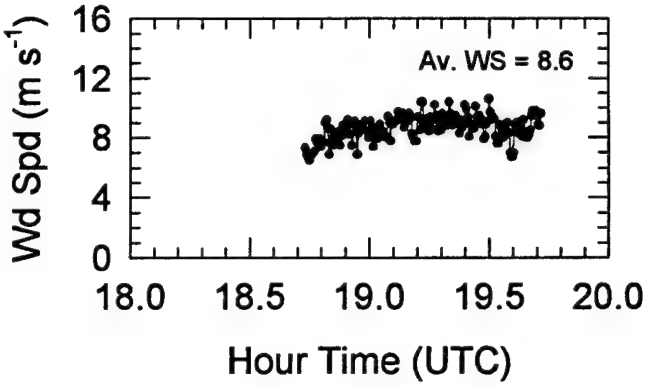


TRIAL 2691244

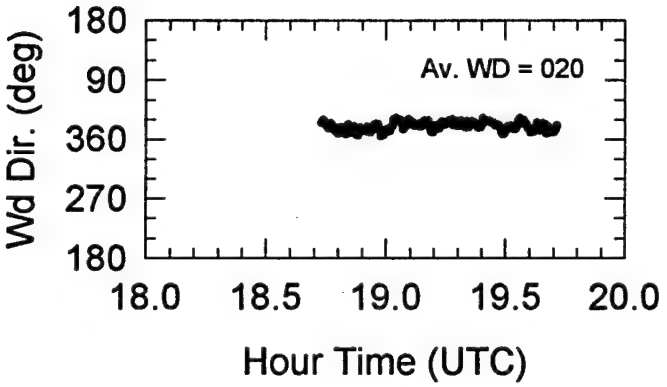
2-m Mast Wind Data

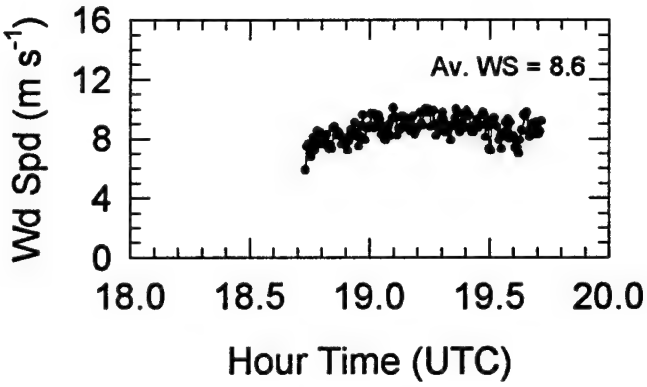
Met Observation Site



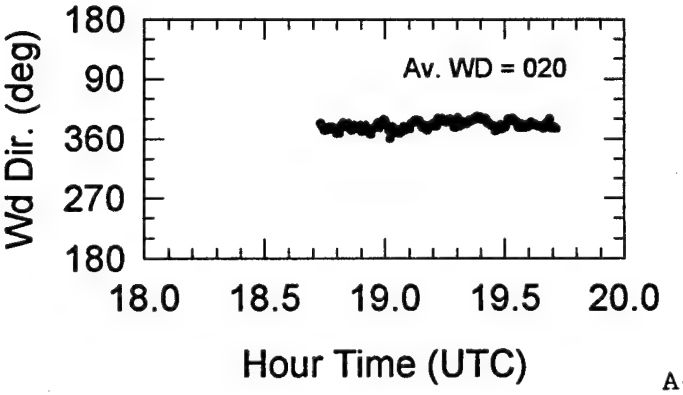


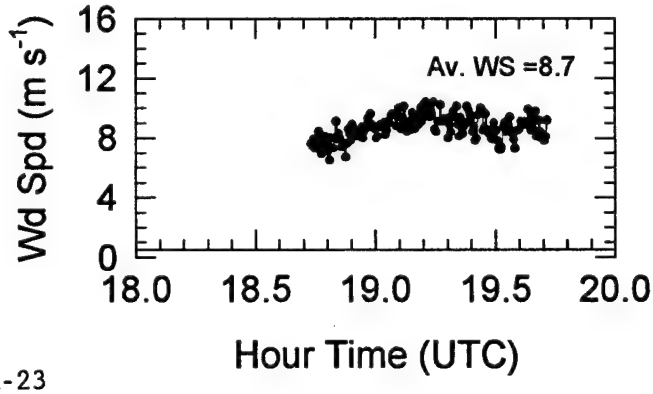
CP Site





1 Km Site

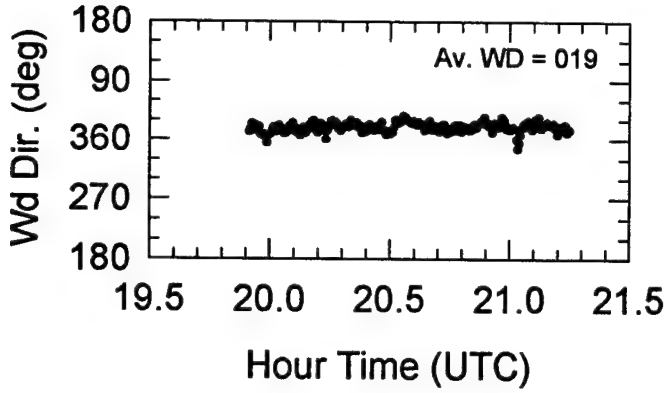


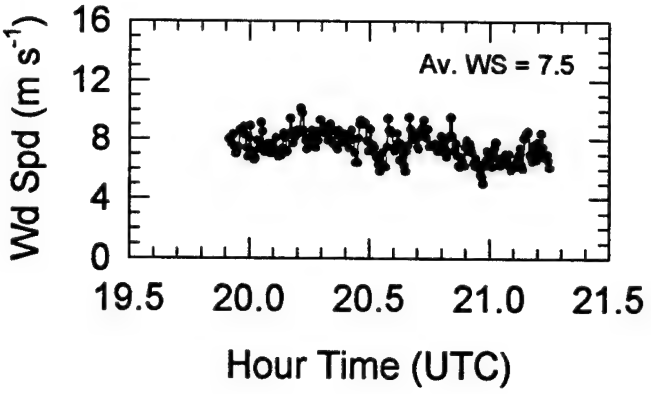


TRIAL 2691355

2-m Mast Wind Data

Met Observation Site





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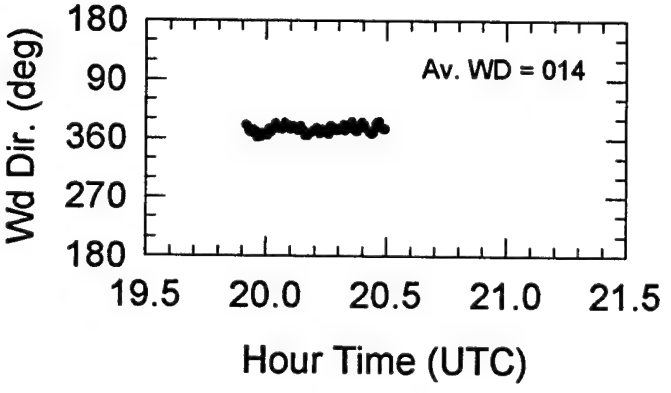

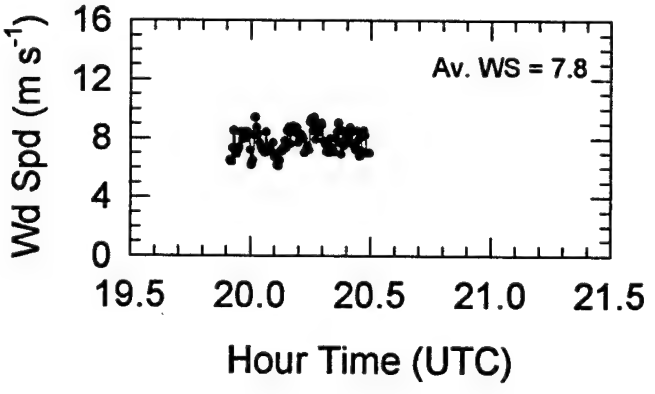

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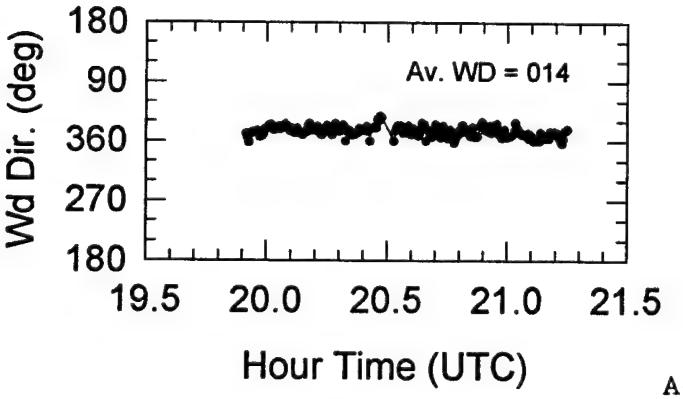
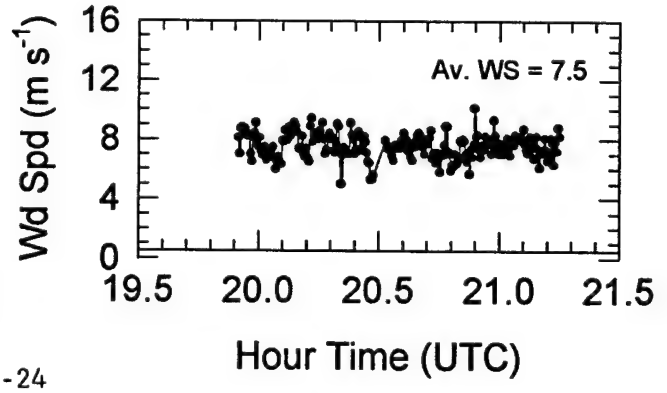
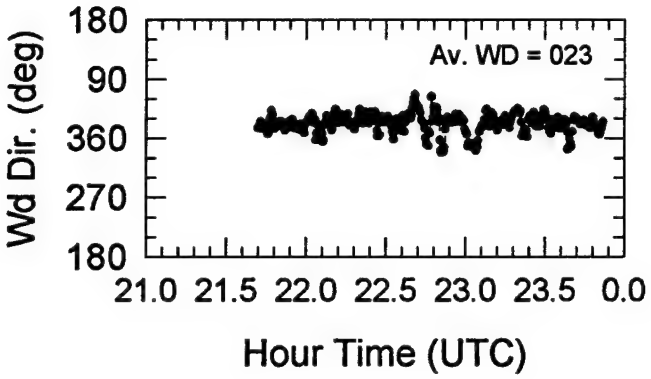


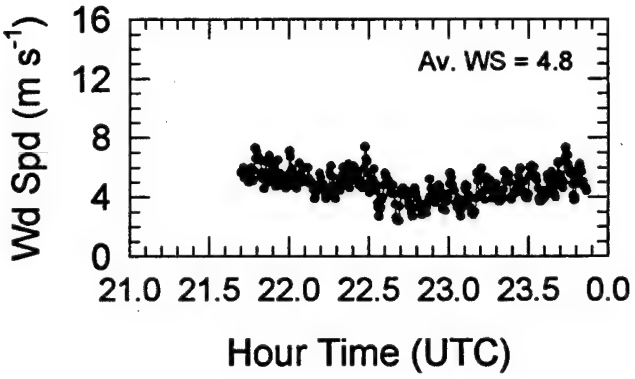


TRIAL 2691542

2-m Mast Wind Data

Met Observation Site





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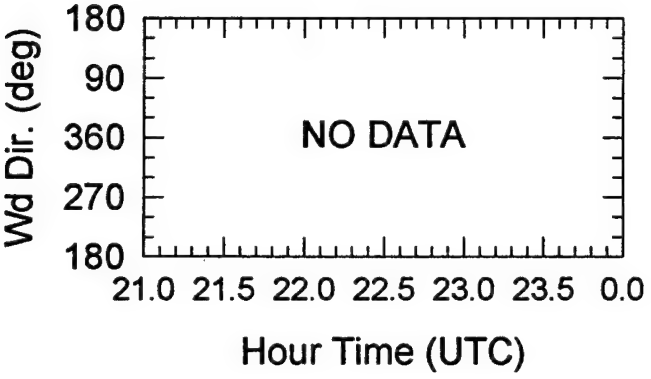

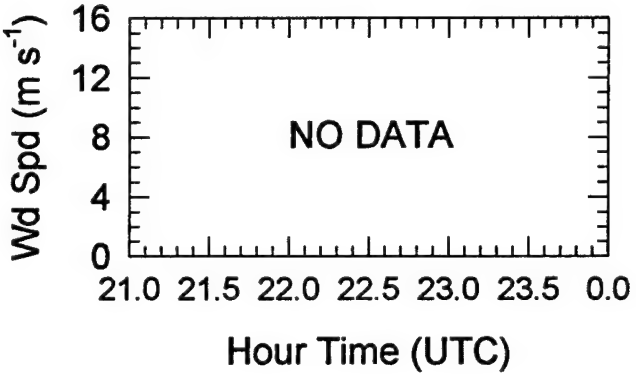

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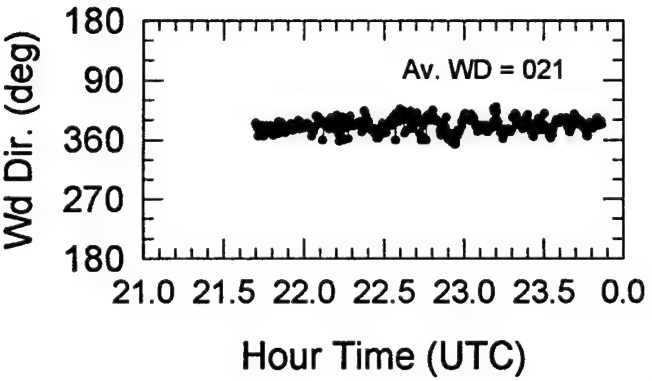
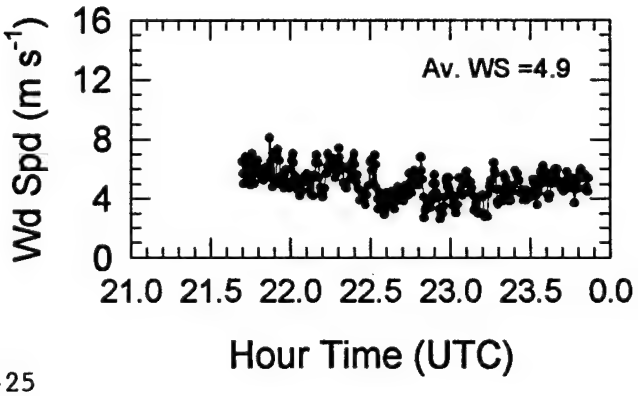
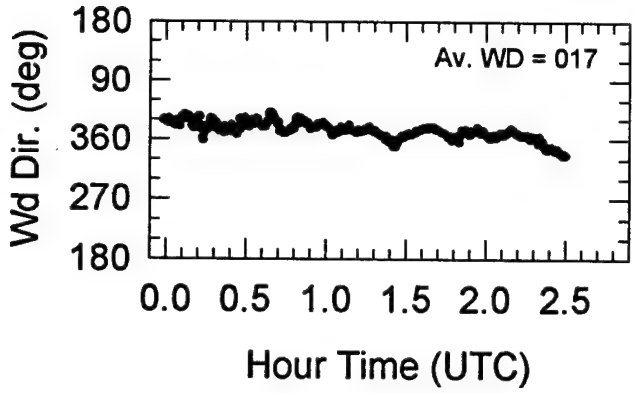


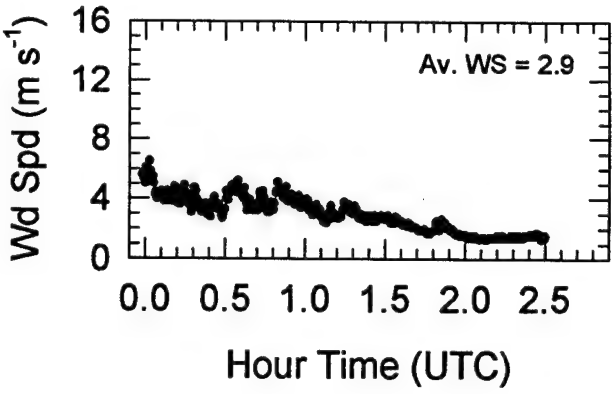


TRIAL 2691800

2-m Mast Wind Data

Met Observation Site





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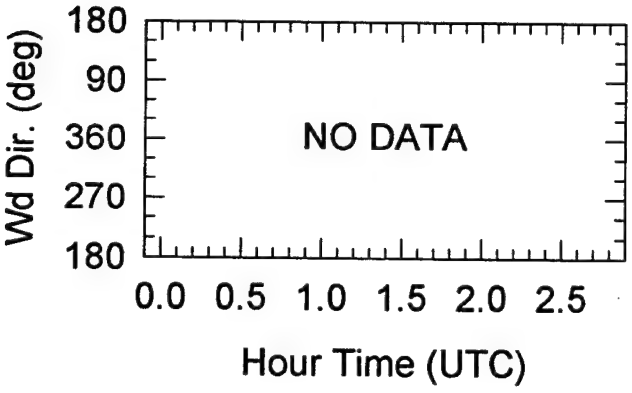

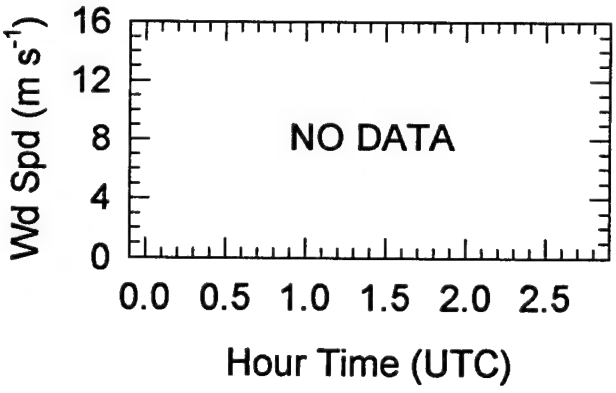

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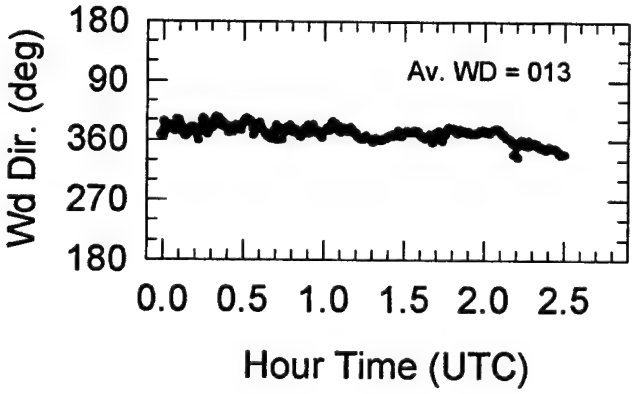
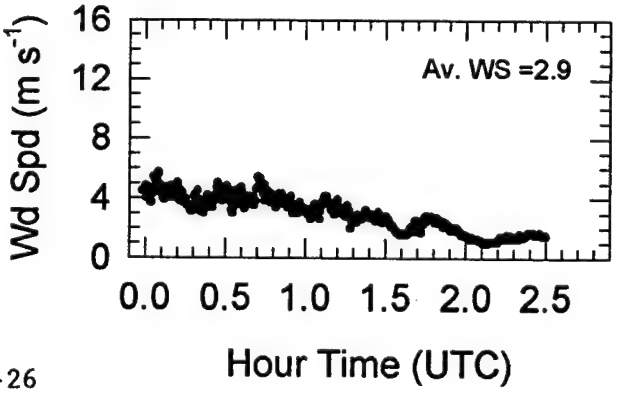
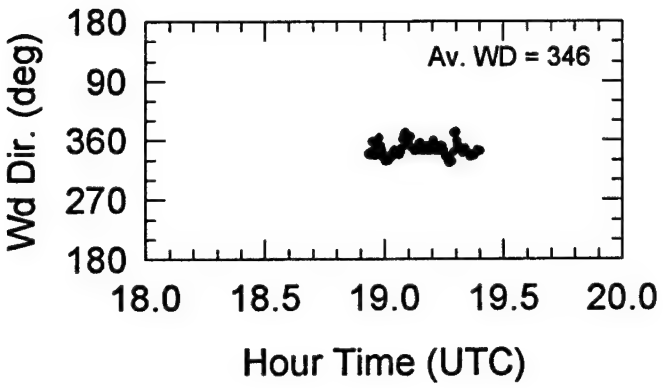


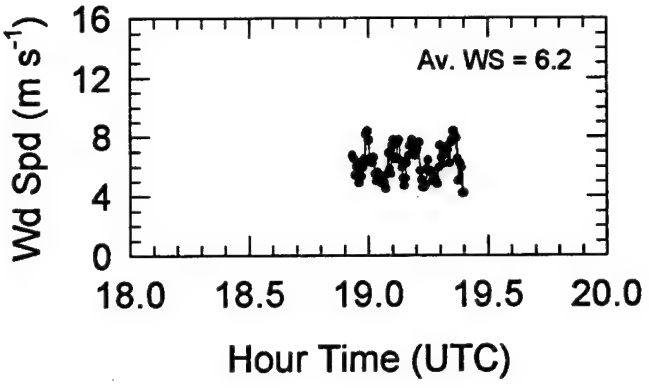


TRIAL 2701256

2-m Mast Wind Data

Met Observation Site





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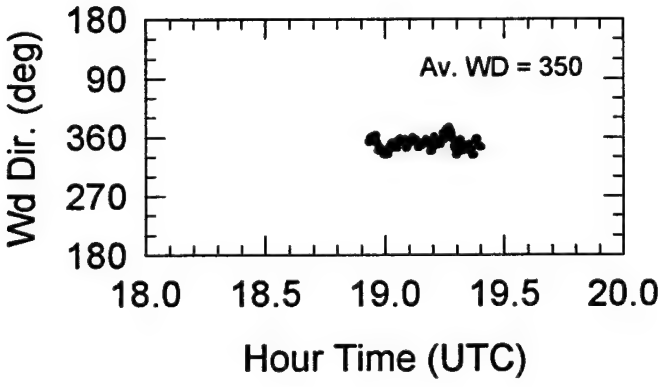

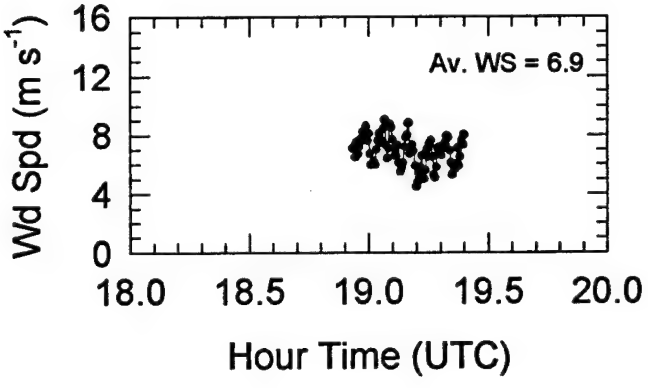

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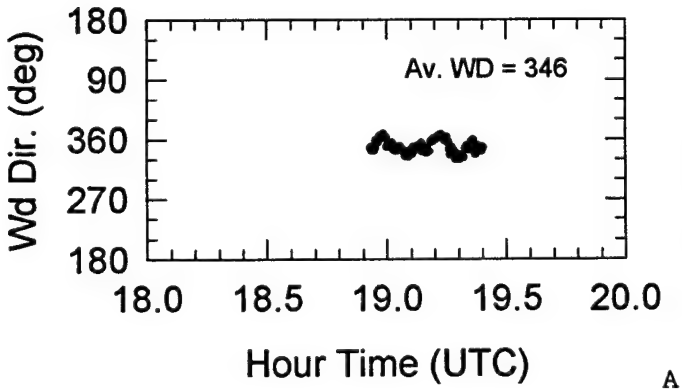
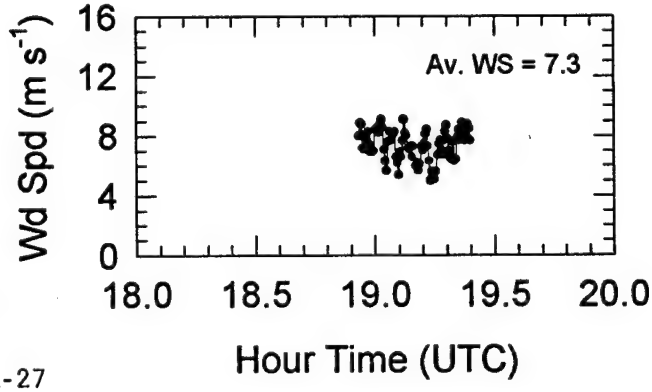
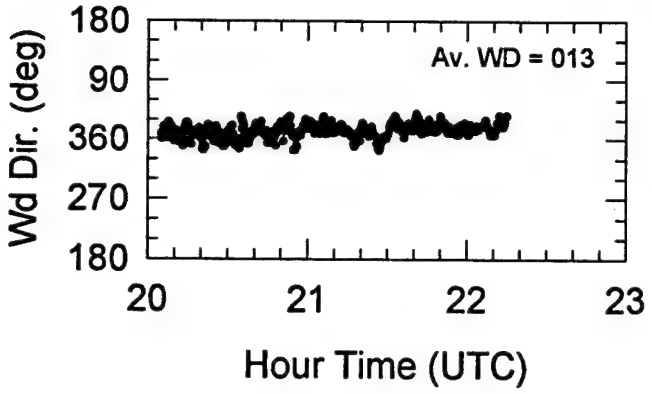


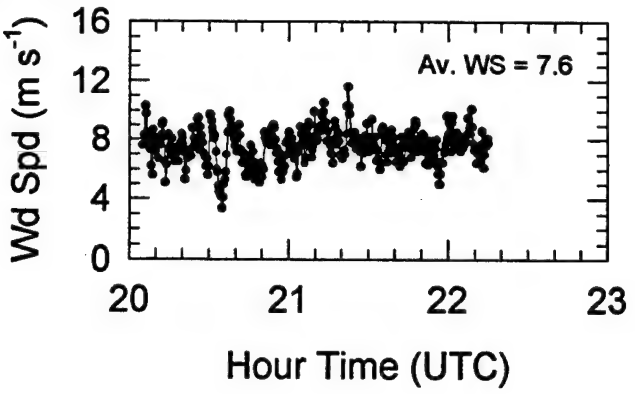


TRIAL 2701405

2-m Mast Wind Data

Met Observation Site





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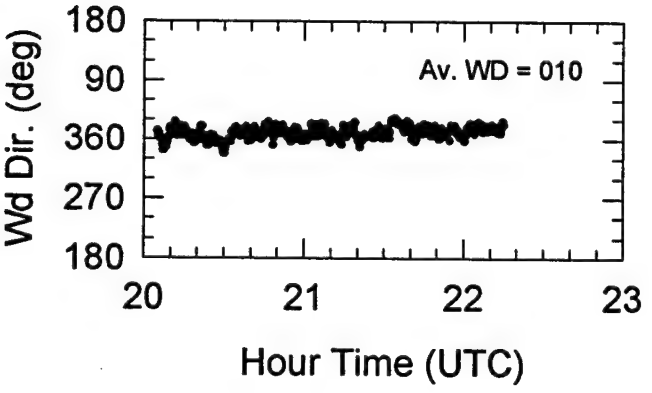

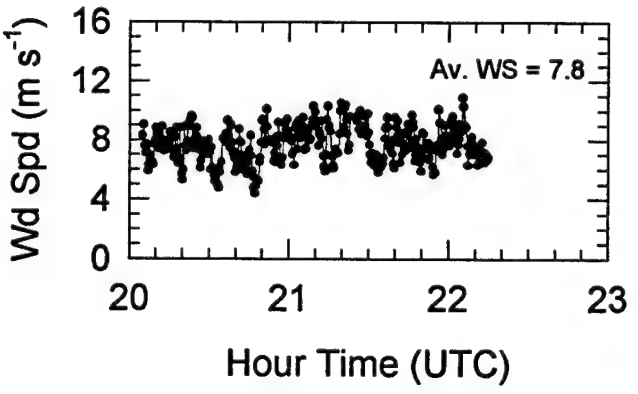

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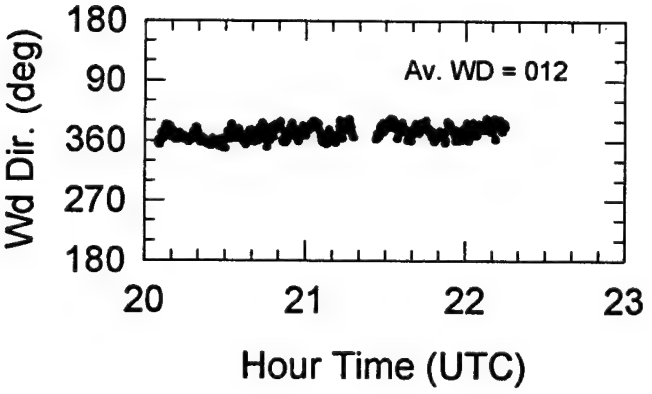
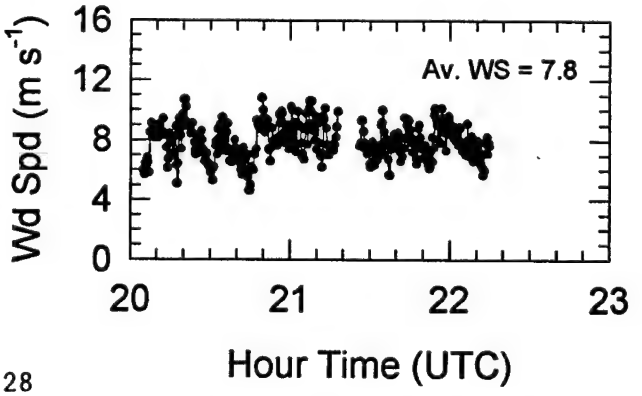
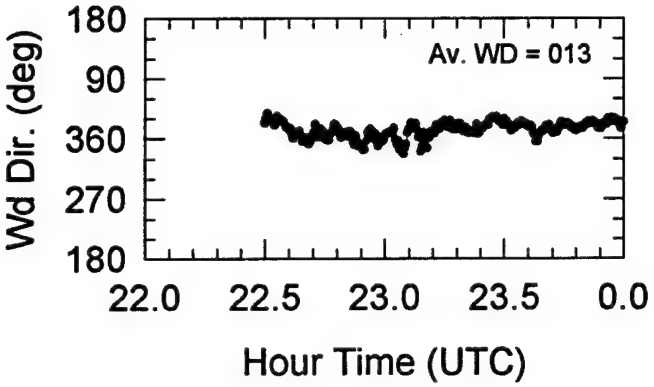


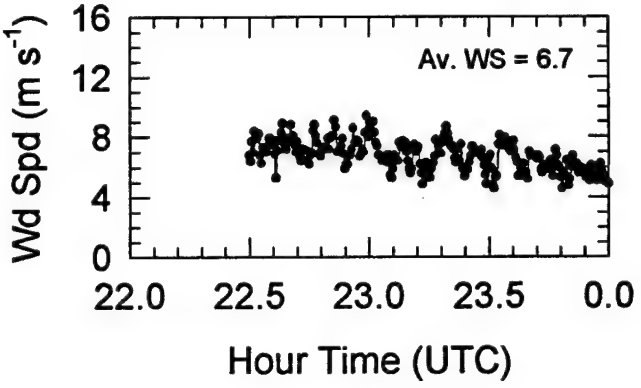


TRIAL 2701630

2-m Mast Wind Data

Met Observation Site





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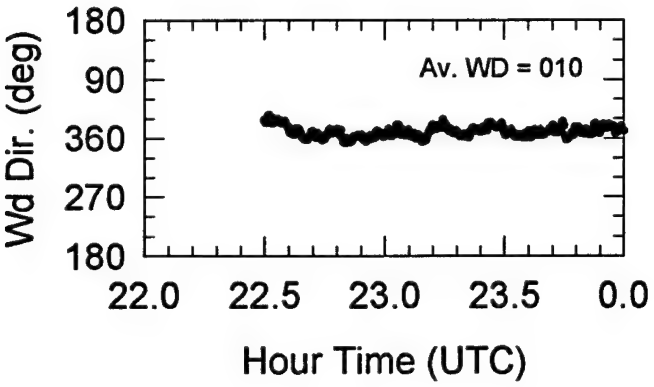

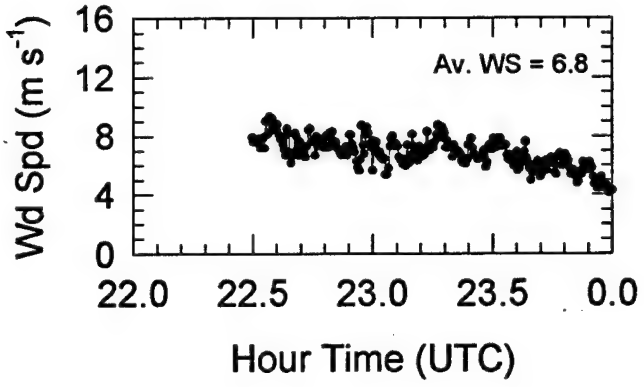

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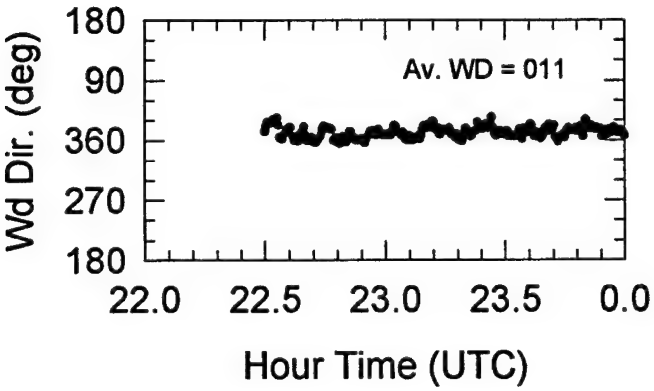
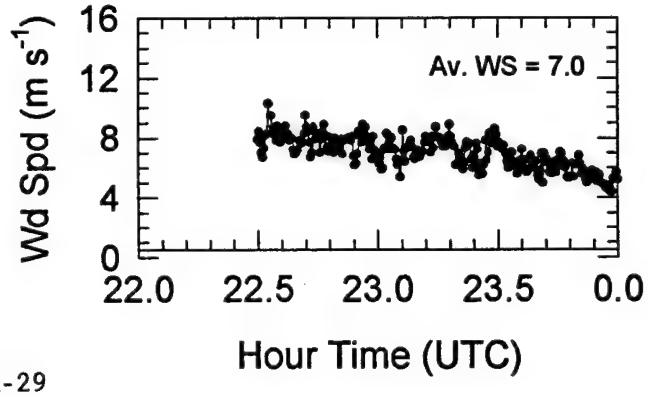
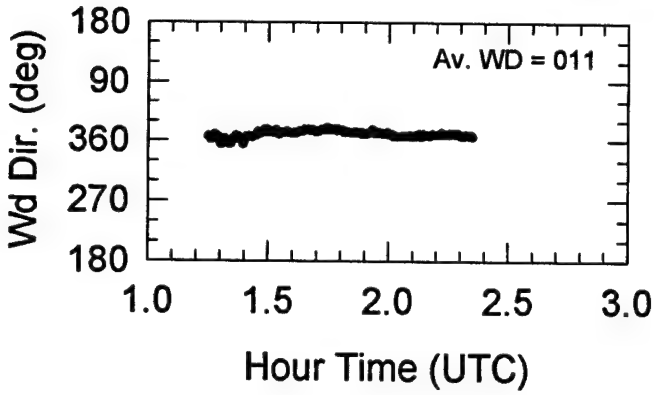


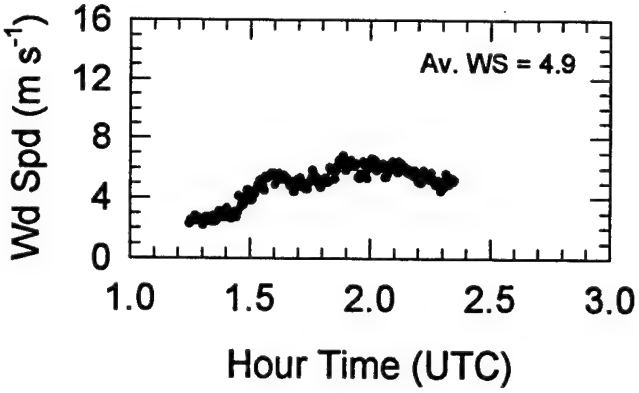


TRIAL 2701915

2-m Mast Wind Data

Met Observation Site





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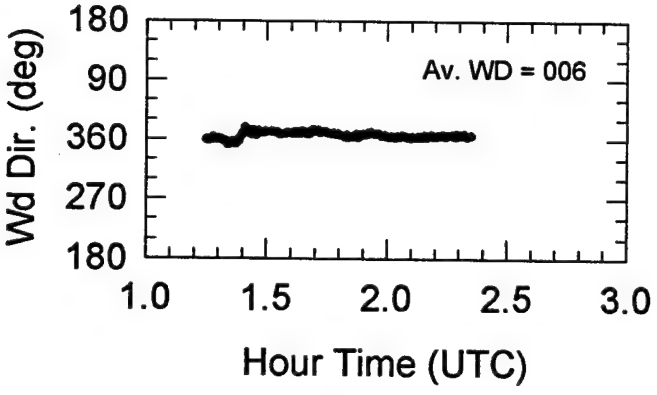

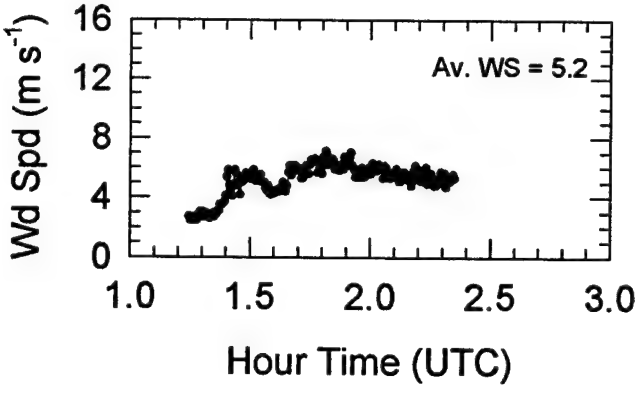

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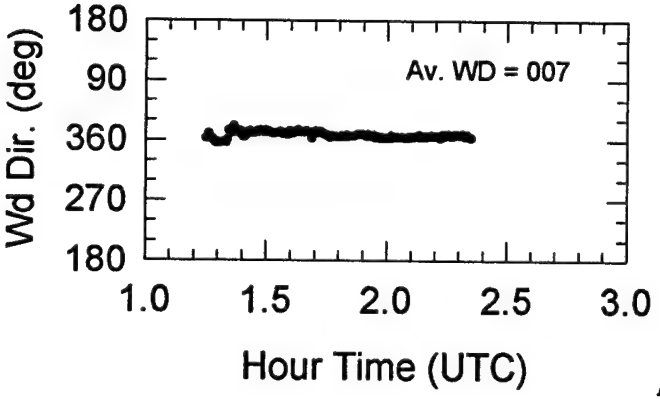
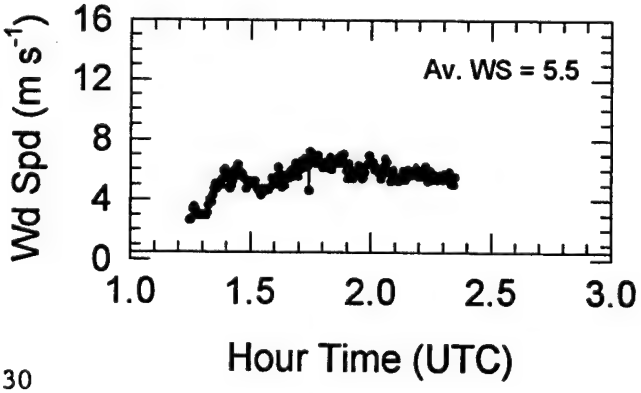
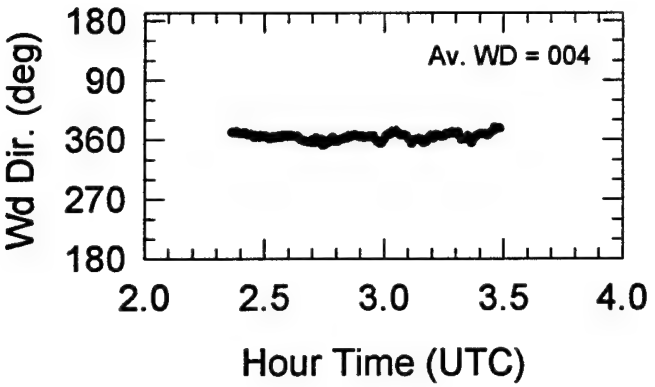


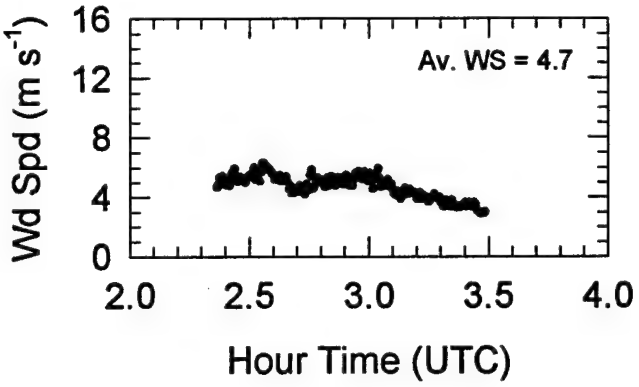


TRIAL 2702022

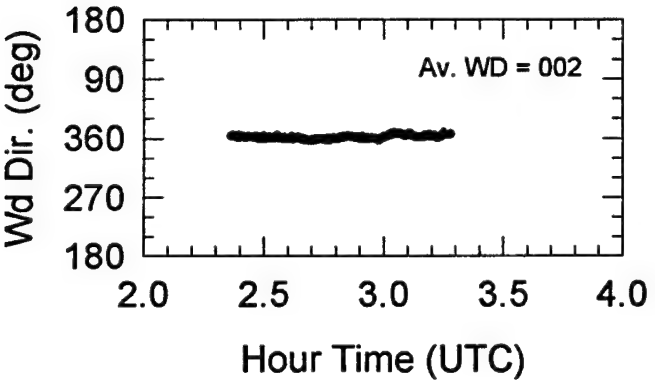
2-m Mast Wind Data

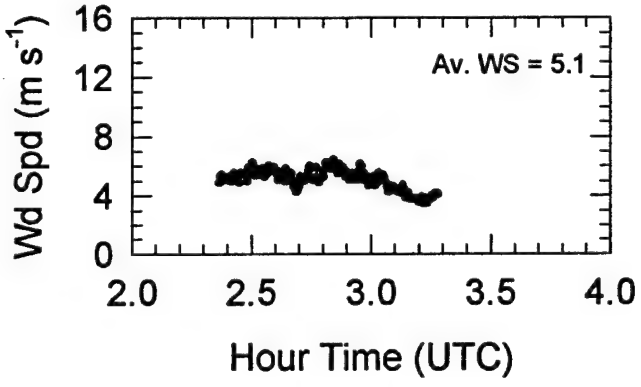
Met Observation Site





CP Site





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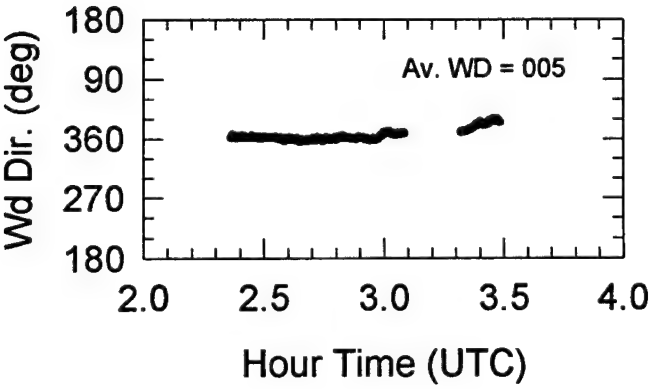
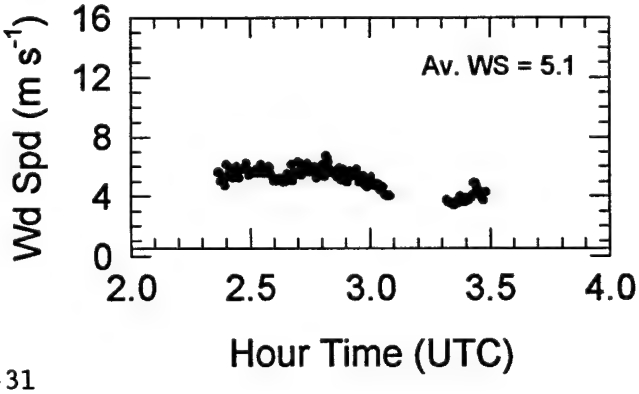


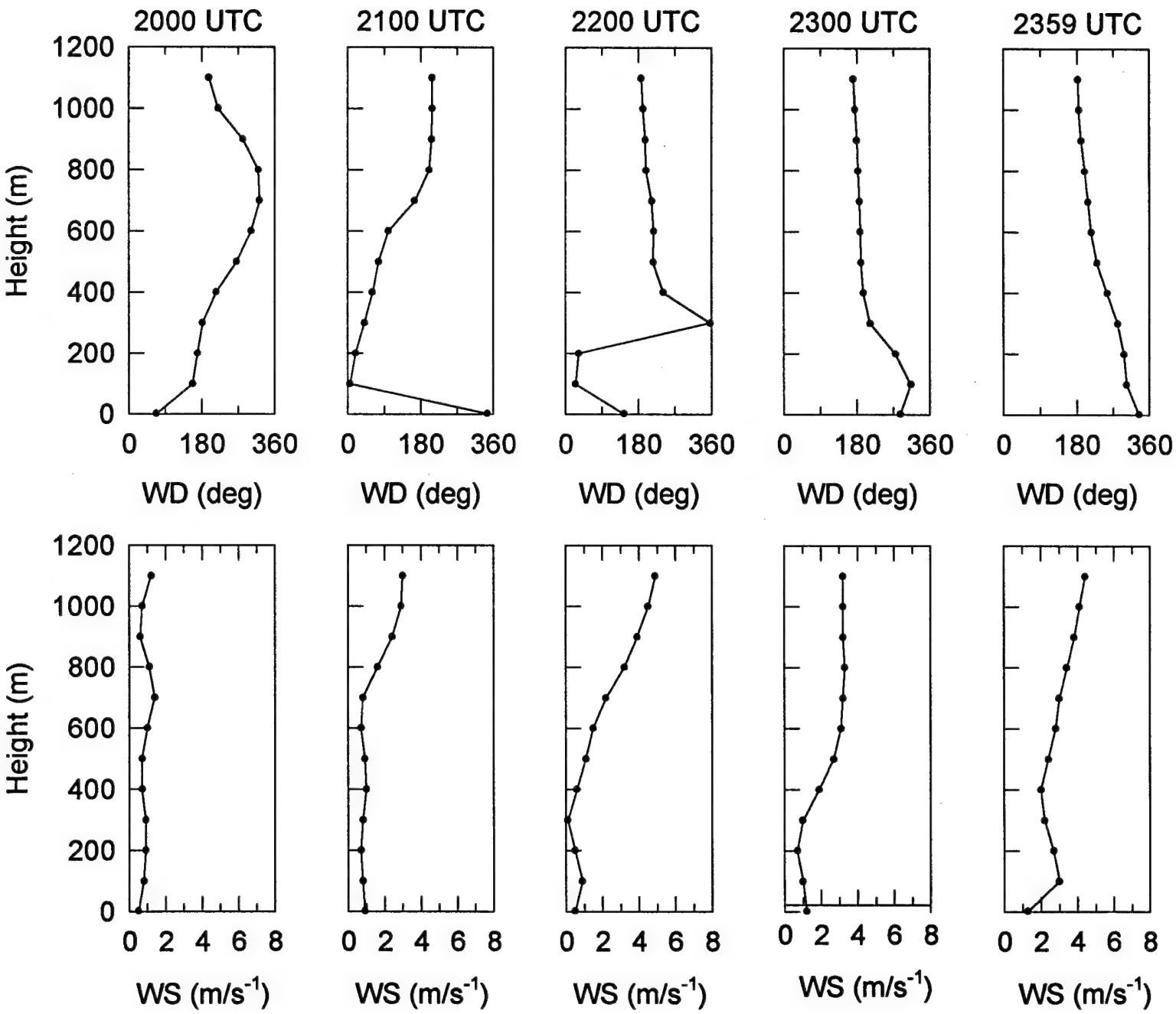


A.2 PIBAL AND TETHERSONDE DATA

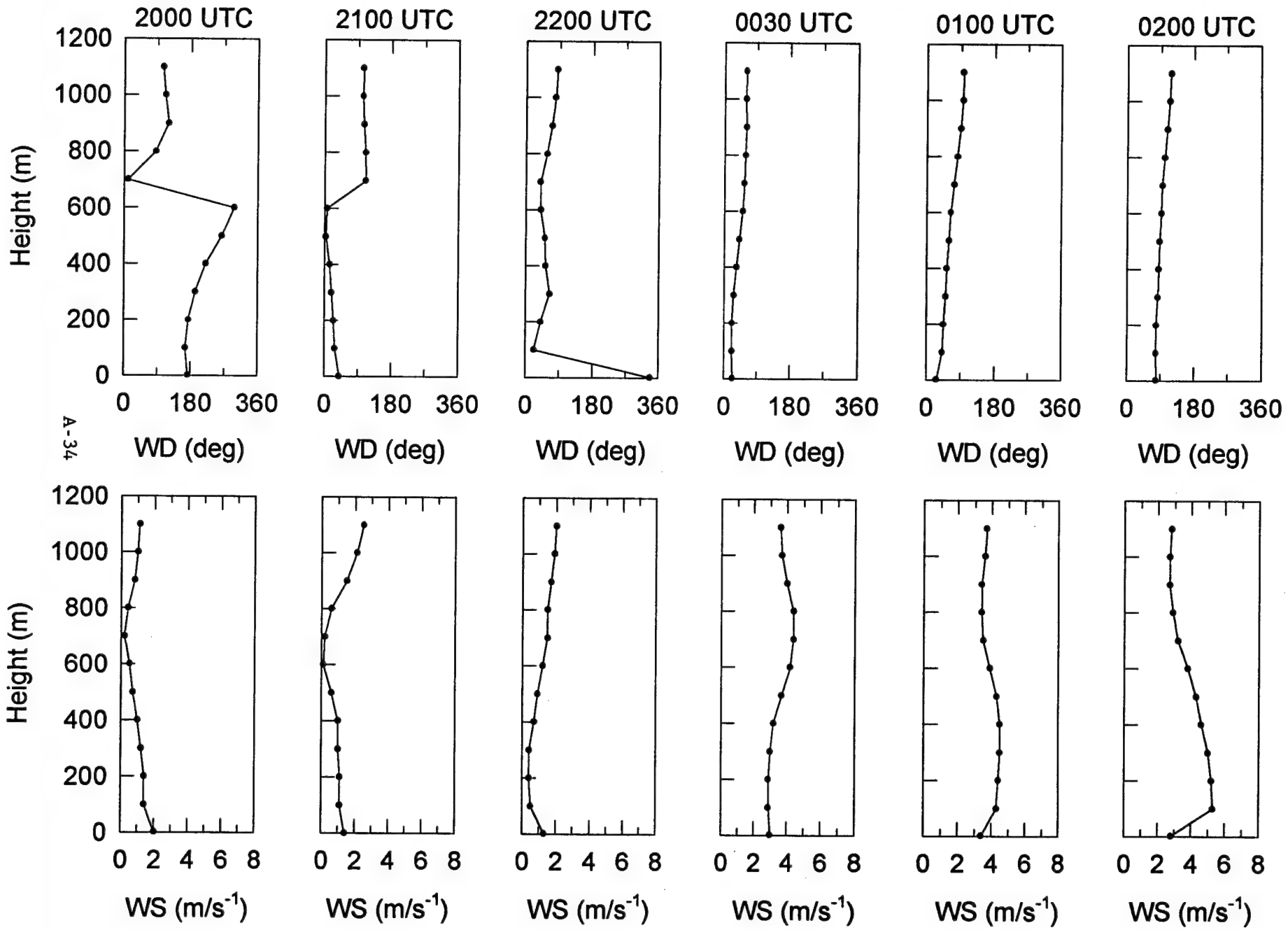
A.2.1 Plots

Pibals and tethersondes were flown from the meteorological observation site (see Figure 2) to document wind profiles and mixing heights. Either a tethersonde or pibal flight was taken within a hour of the beginning and ending of each trial. Additional flights were done to document the evolution of the wind field during each trial day. Pibals were generally flown at the beginning of each trial day and continued to be used if the wind profile included wind speeds in excess of 10 m/s. Tethersondes were used when wind speeds fell below this threshold. The pibal and tethersonde flight data are presented in time-sequenced plots stratified by Julian date.

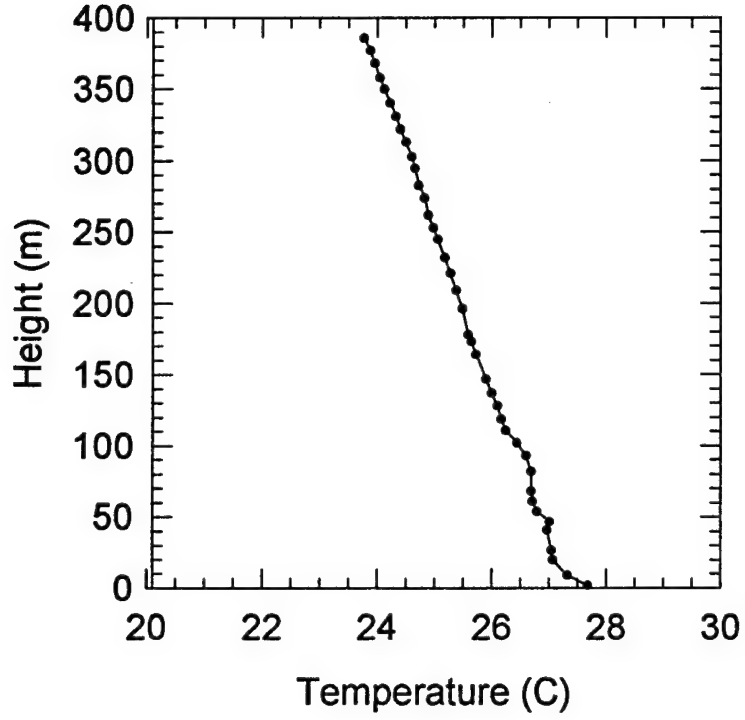
PIBAL DATA - JULIAN DATE 254

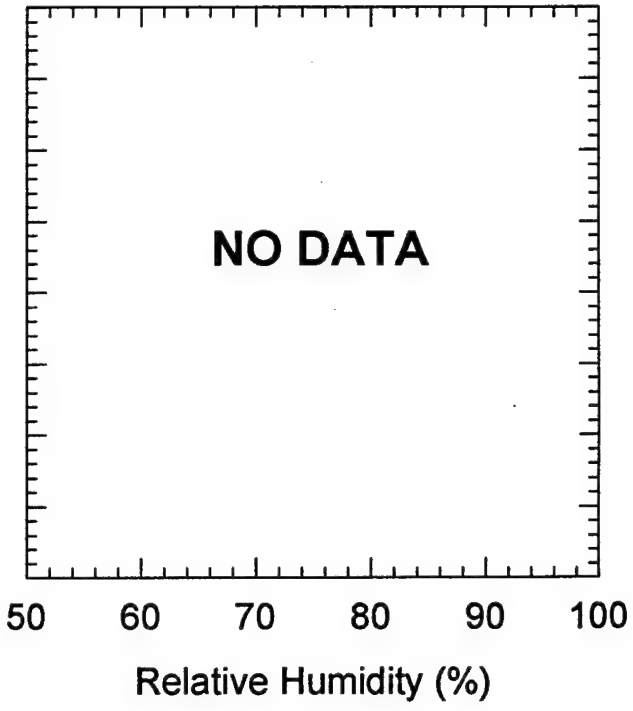


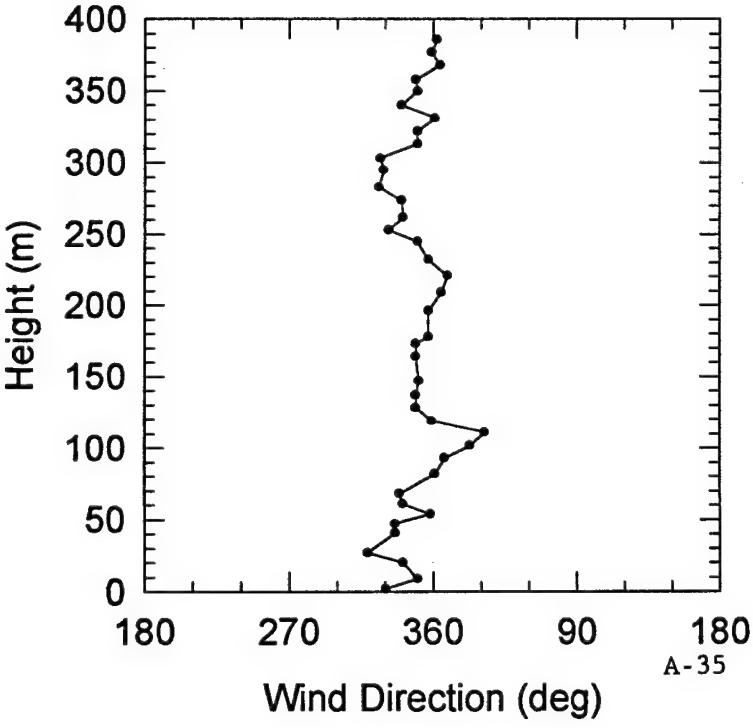
PIBAL DATA - JULIAN DATES 255-256

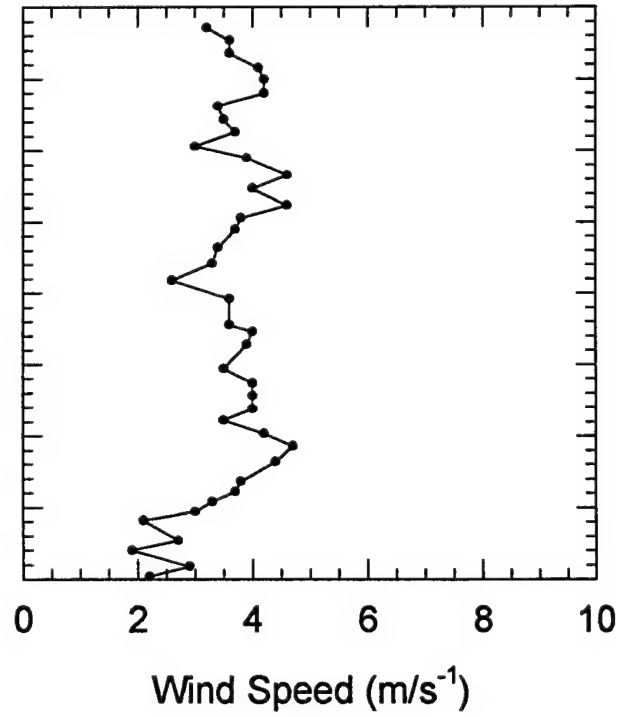


TETHERSONDE DATA - JULIAN DATES 255-256
2322 UTC

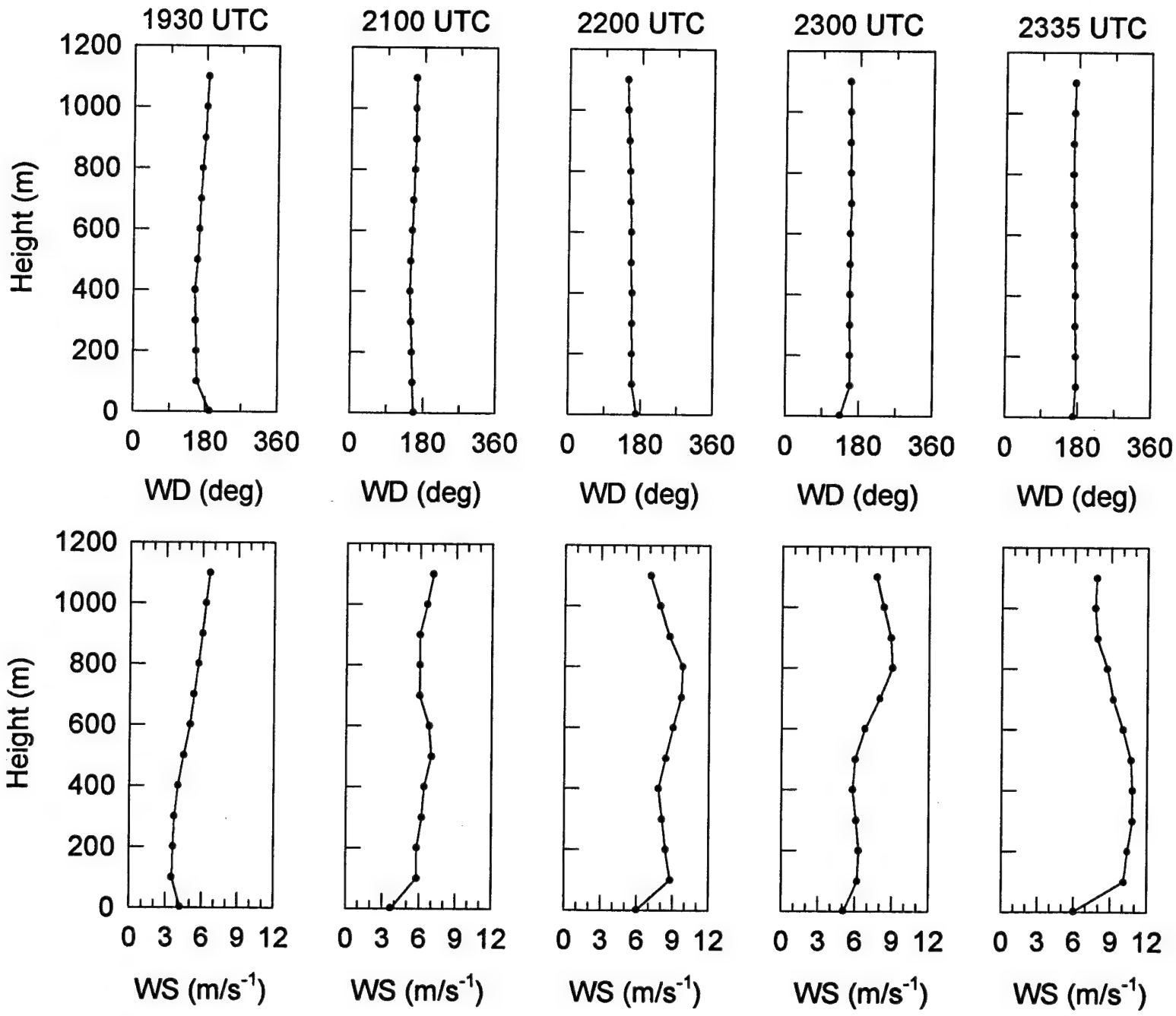




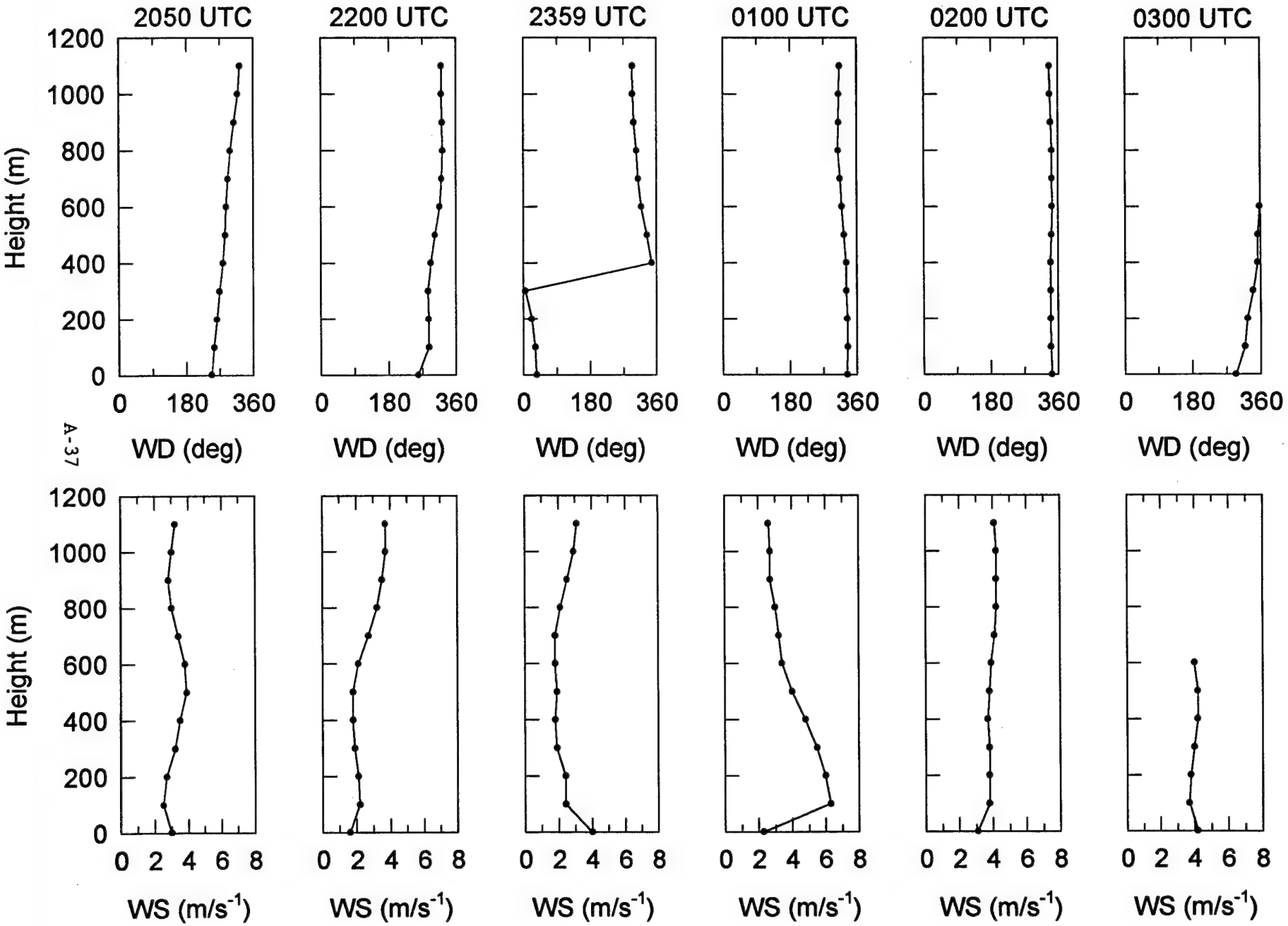




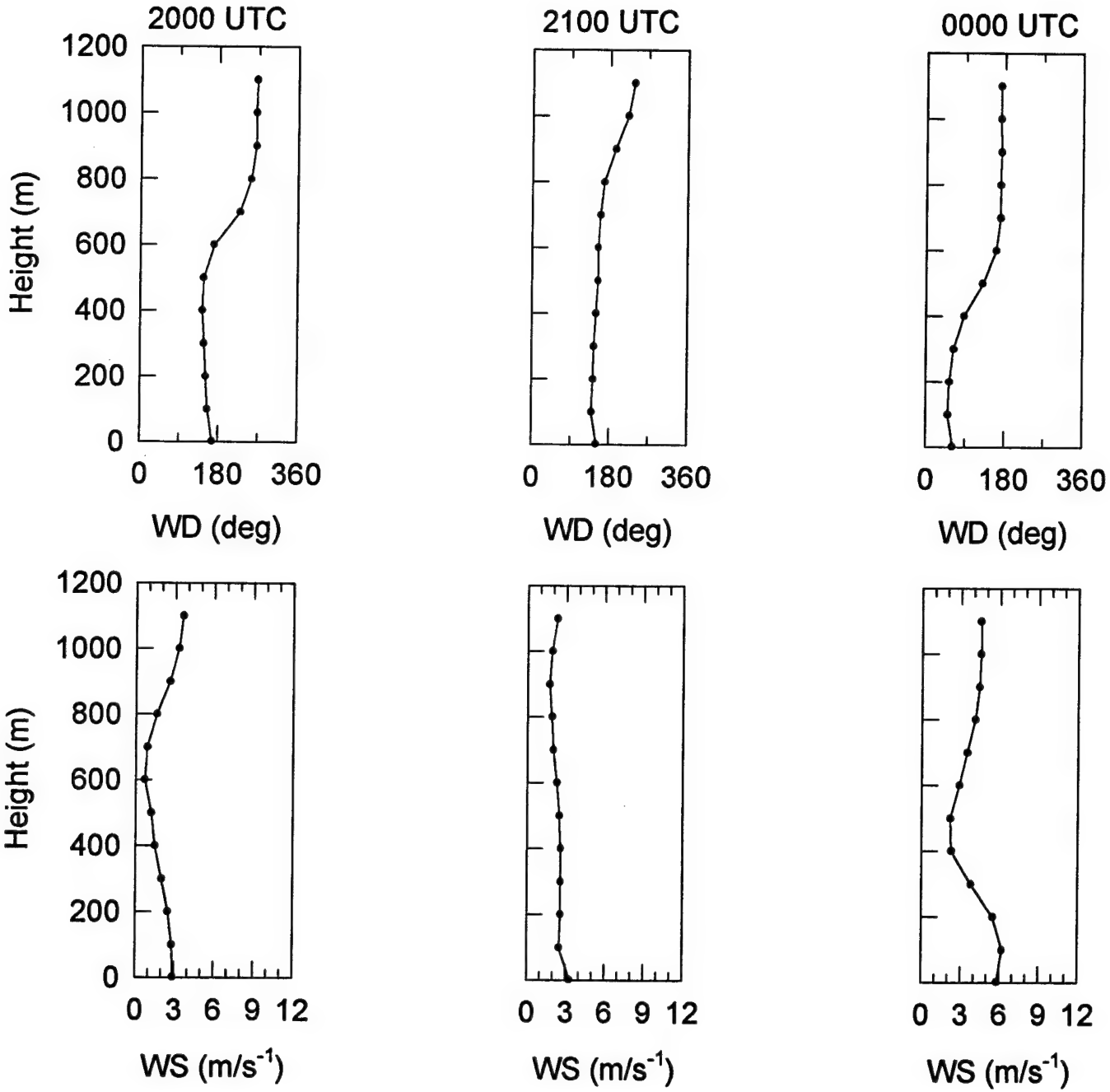
PIBAL DATA - JULIAN DATE 256

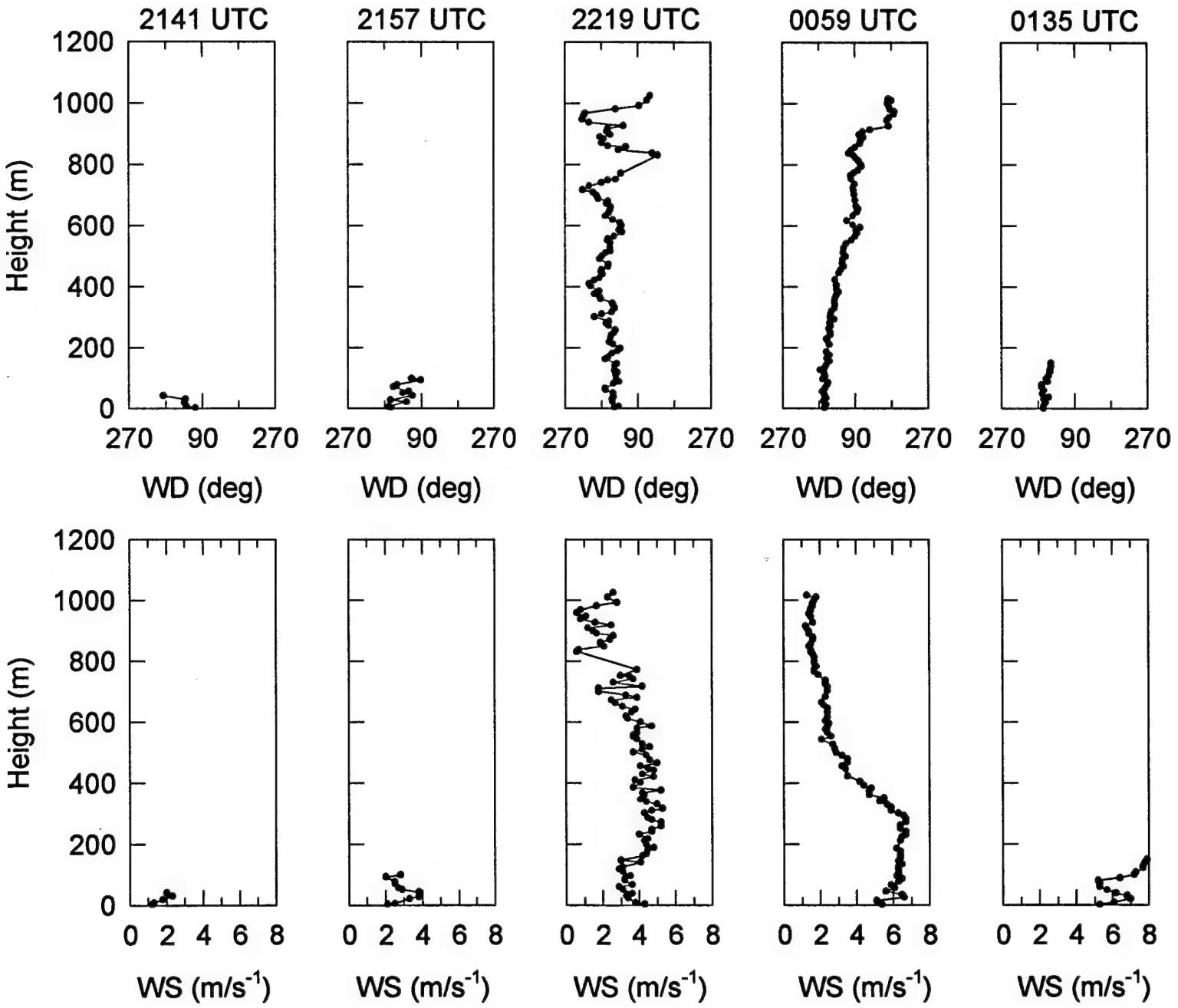


PIBAL DATA - JULIAN DATES 261-262

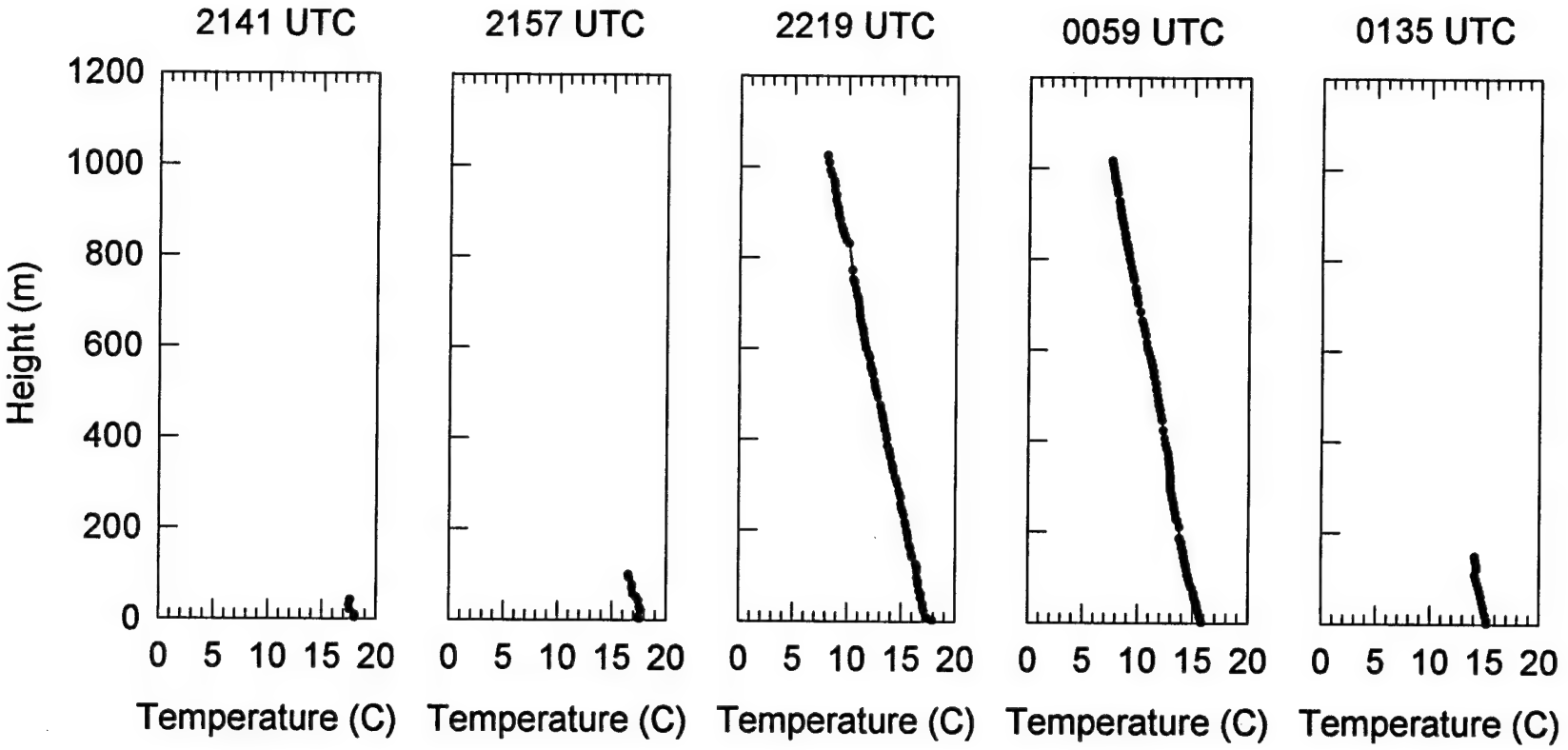


PIBAL DATA - JULIAN DATES 263-264

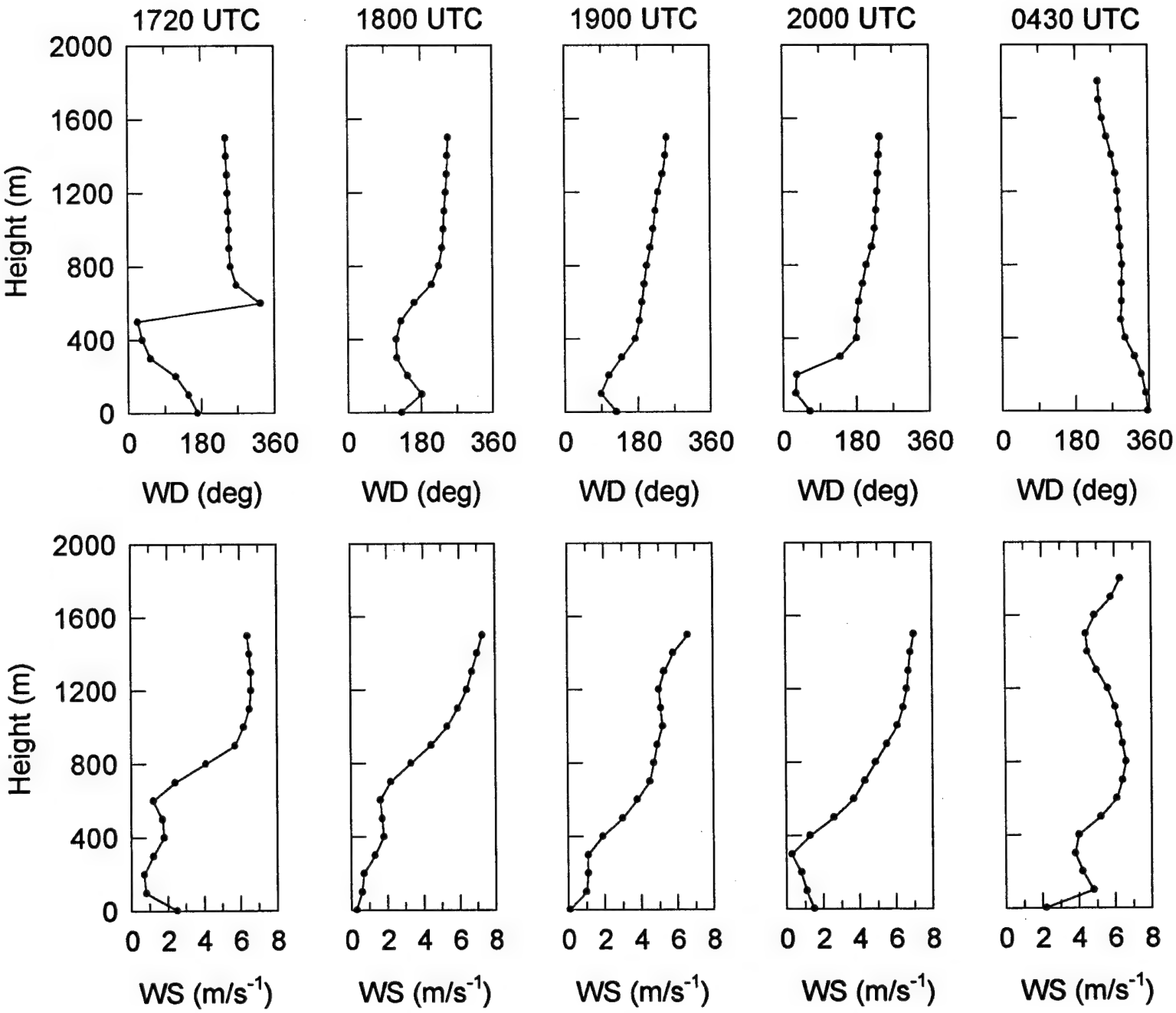



TETHERSONDE WIND DATA - JULIAN DATES 263-264
2141 UTC
2157 UTC
2219 UTC
0059 UTC
0135 UTC
Height (m)
1200
1000
800
600
400
200
0
270 90 270
WD (deg)
0 2 4 6 8
WS (m/s-1)

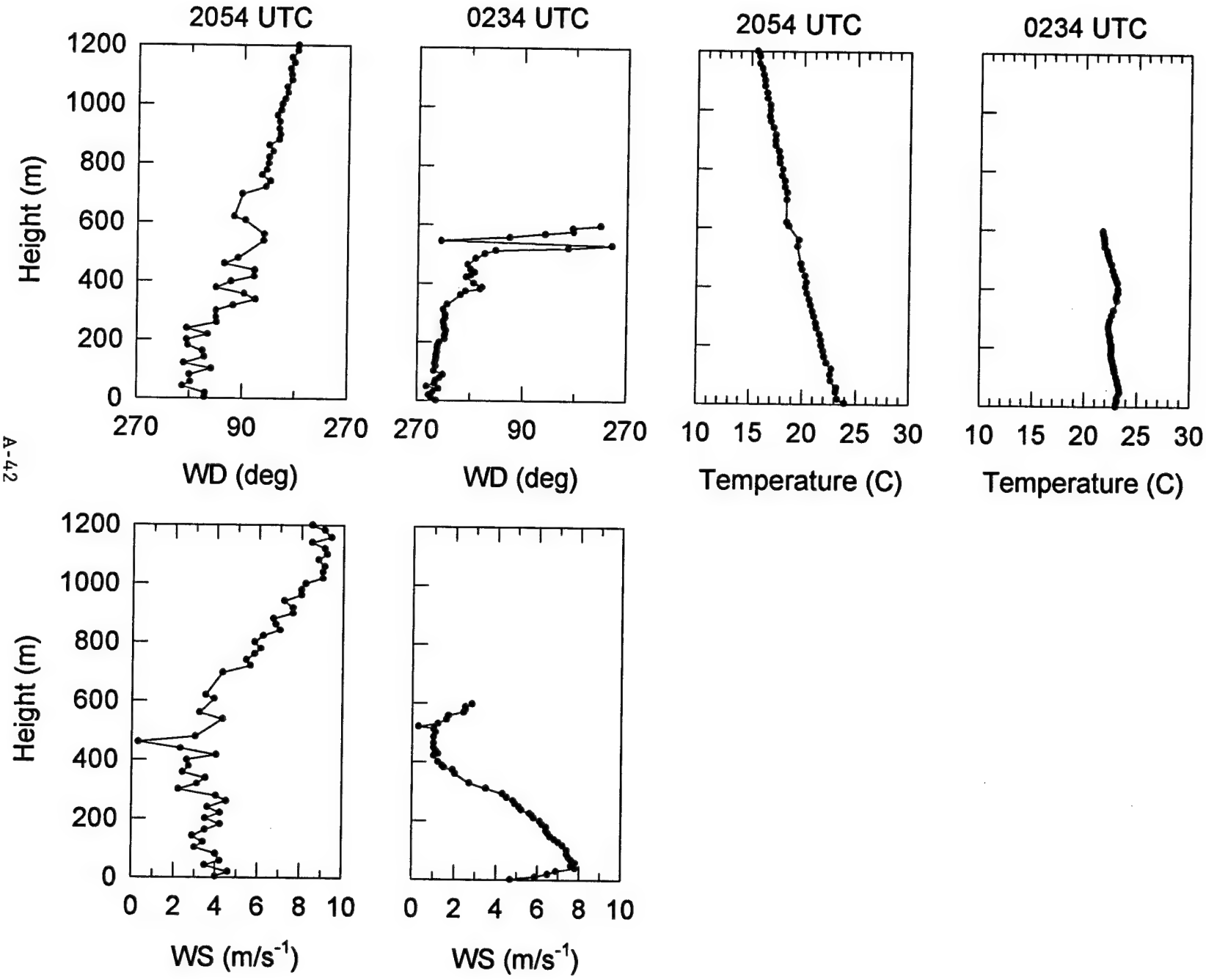
TETHERSONDE TEMPERATURE DATA - JULIAN DATES 263-264



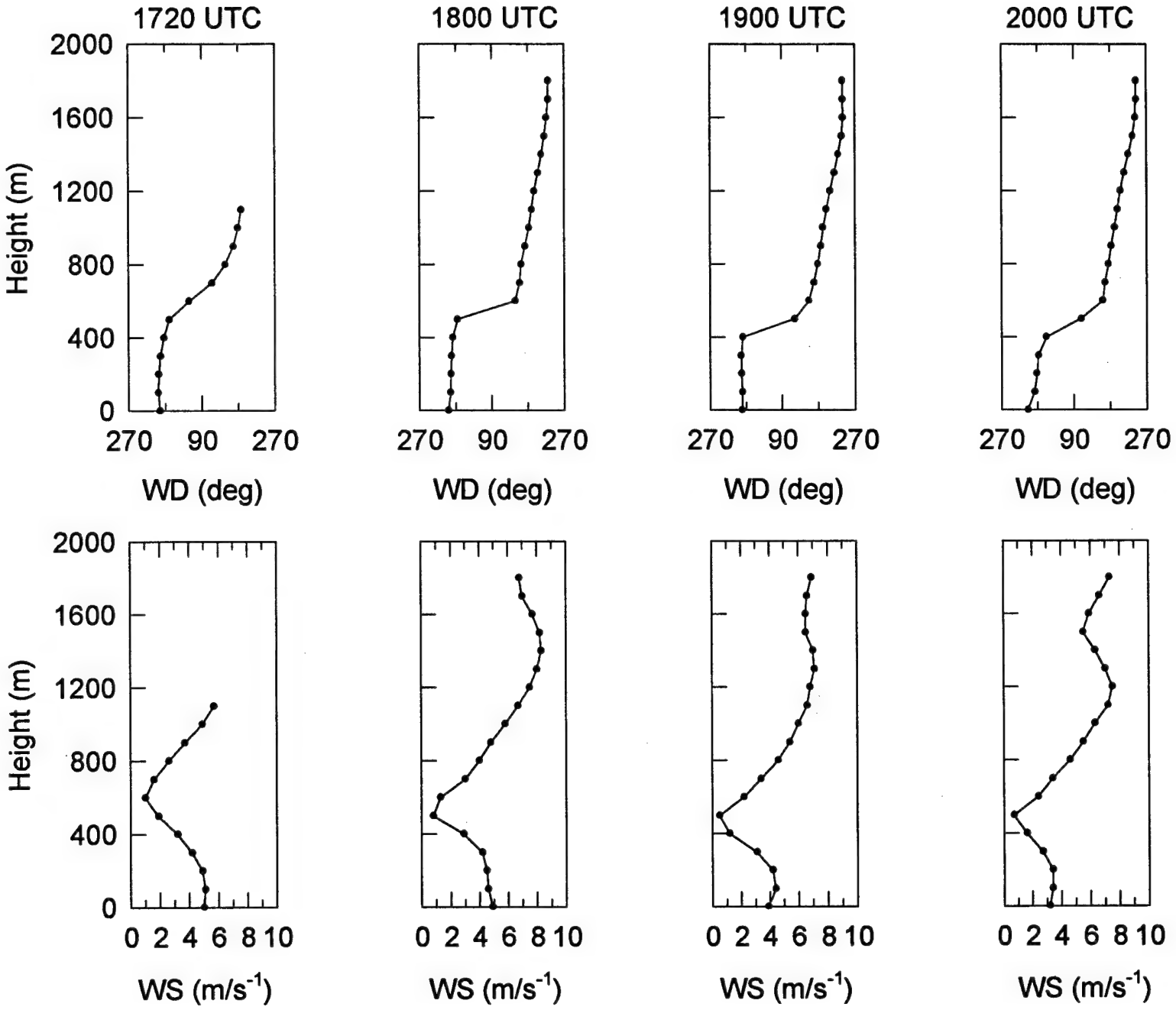
PIBAL DATA - JULIAN DATES 265-266



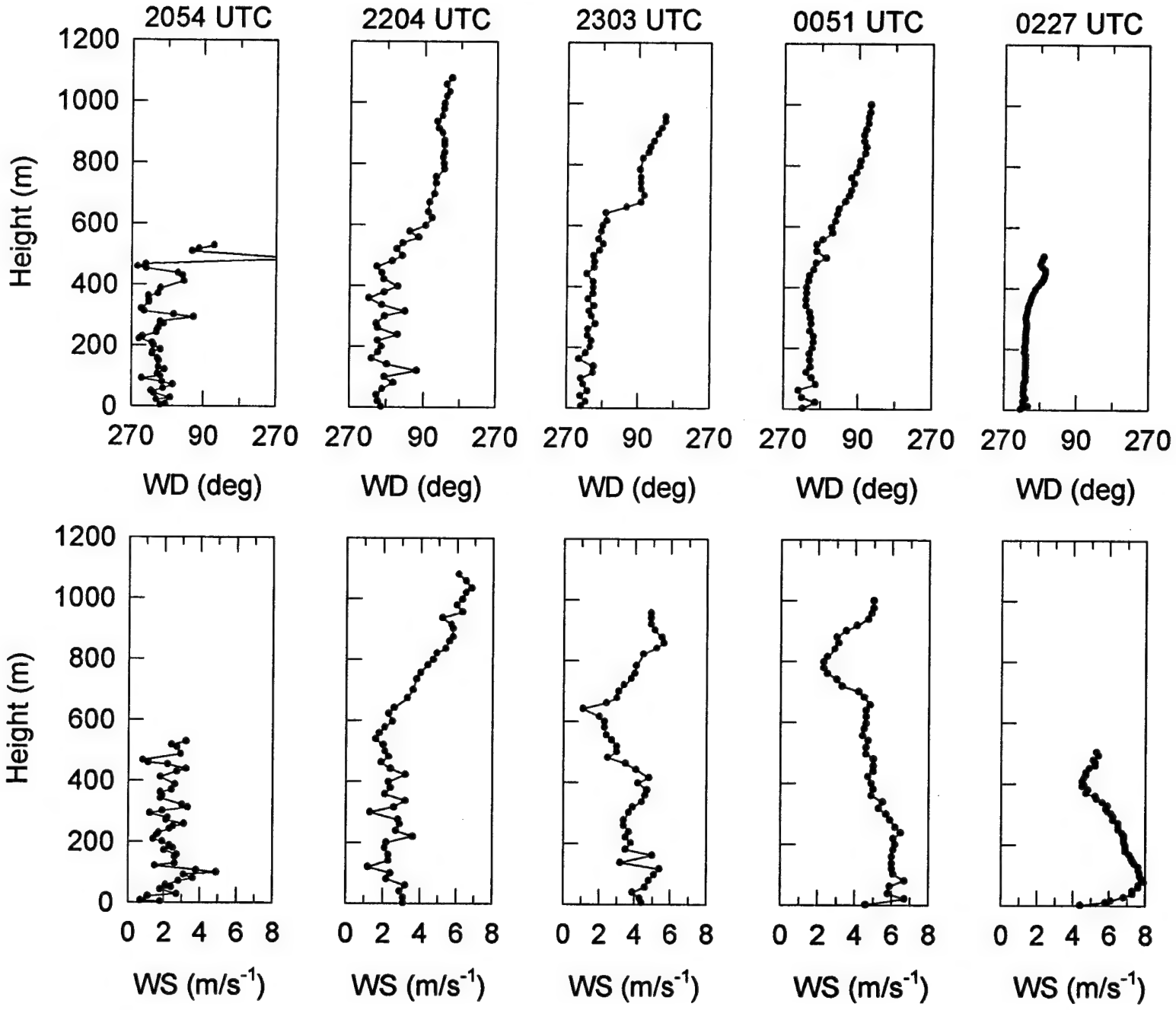
TETHERSONDE WIND DATA - JULIAN DATES 265-266



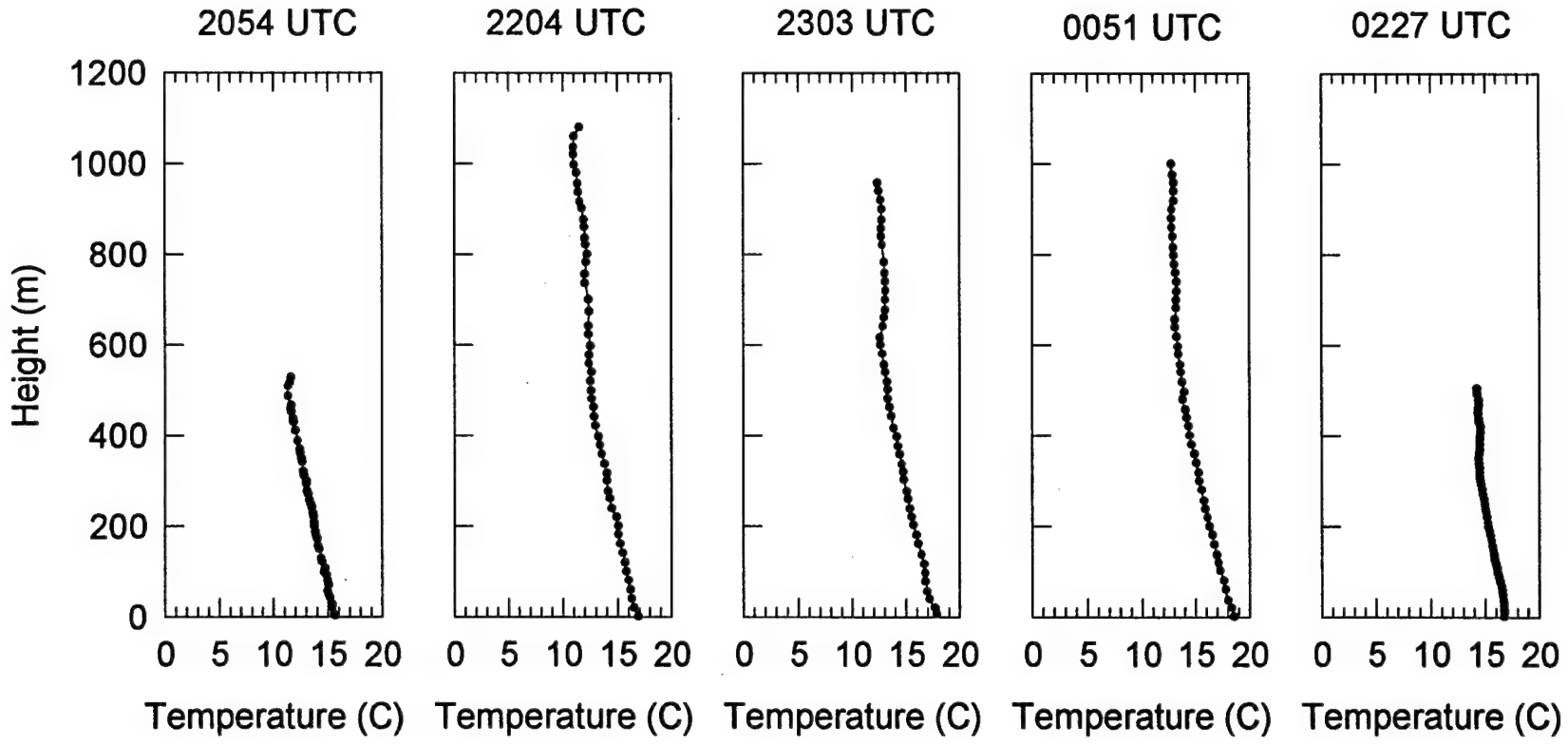
PIBAL DATA - JULIAN DATE 267



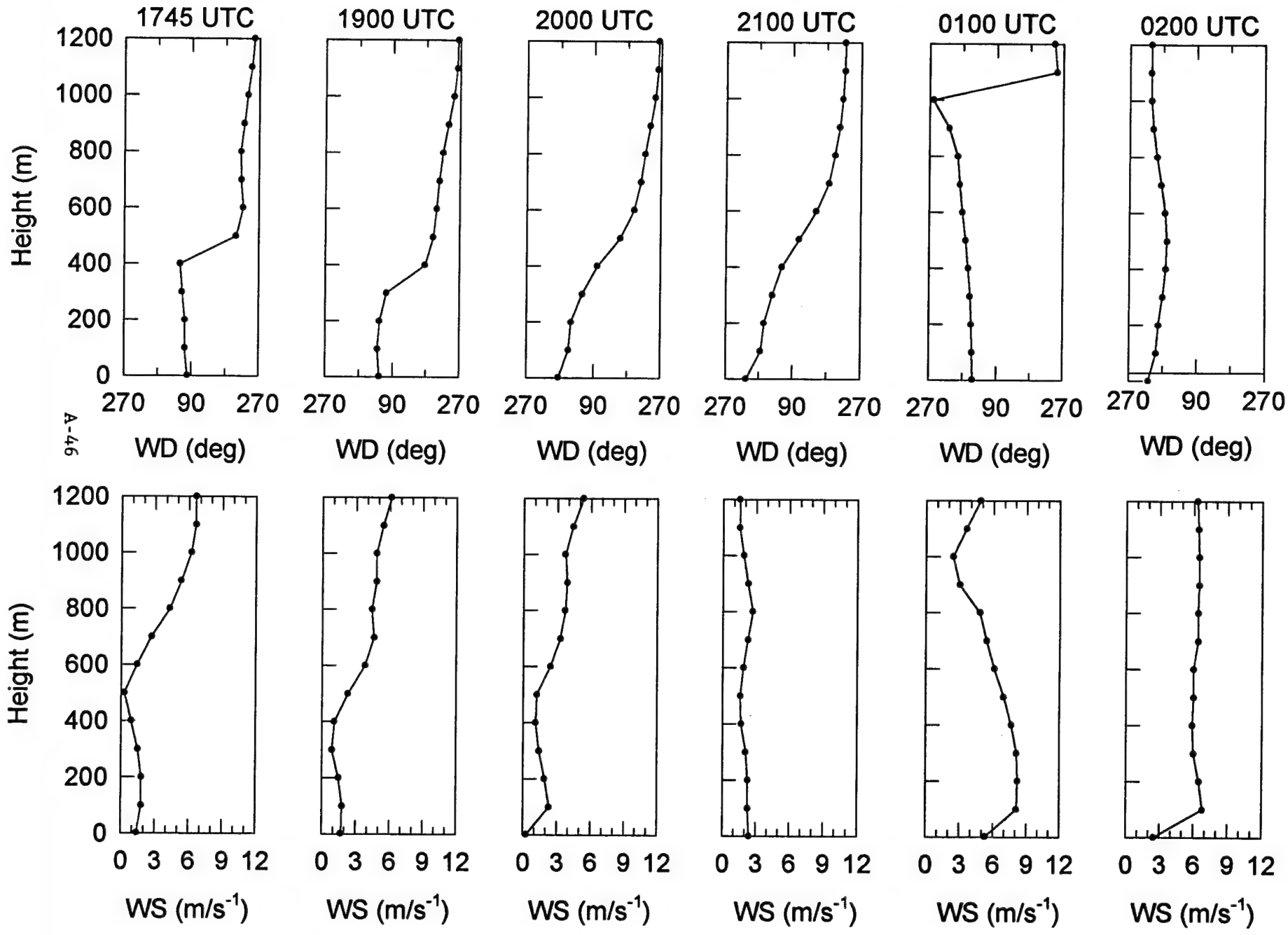
TETHERSONDE WIND DATA - JULIAN DATES 267-268



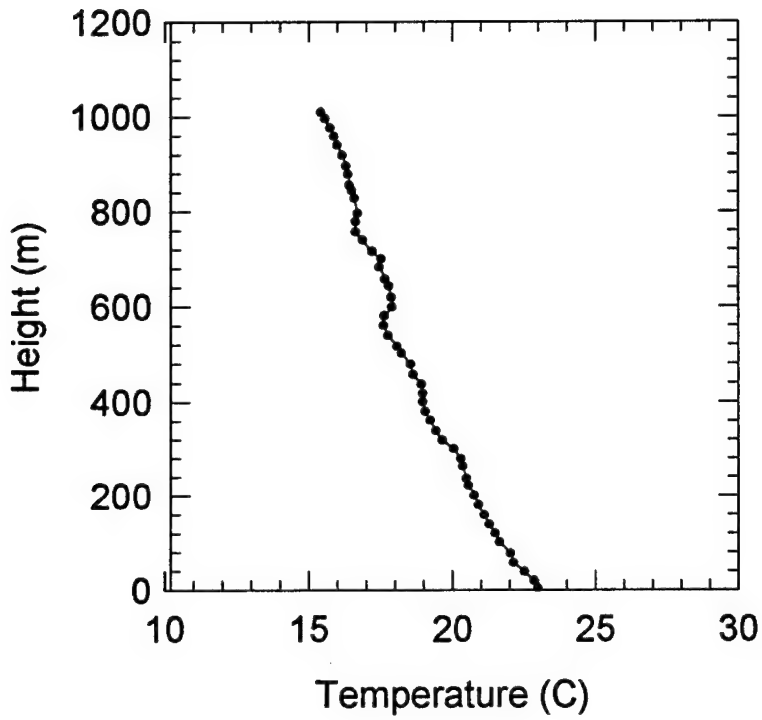
TETHERSONDE TEMPERATURE DATA - JULIAN DATES 267-268

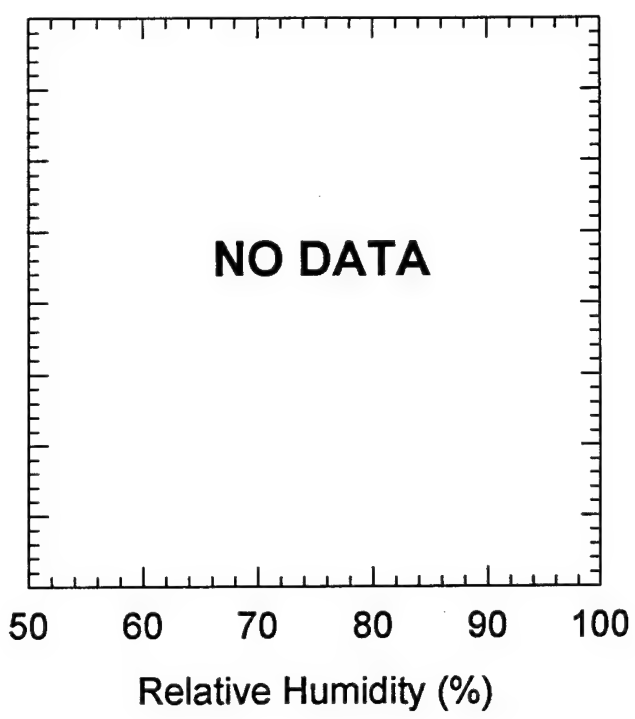


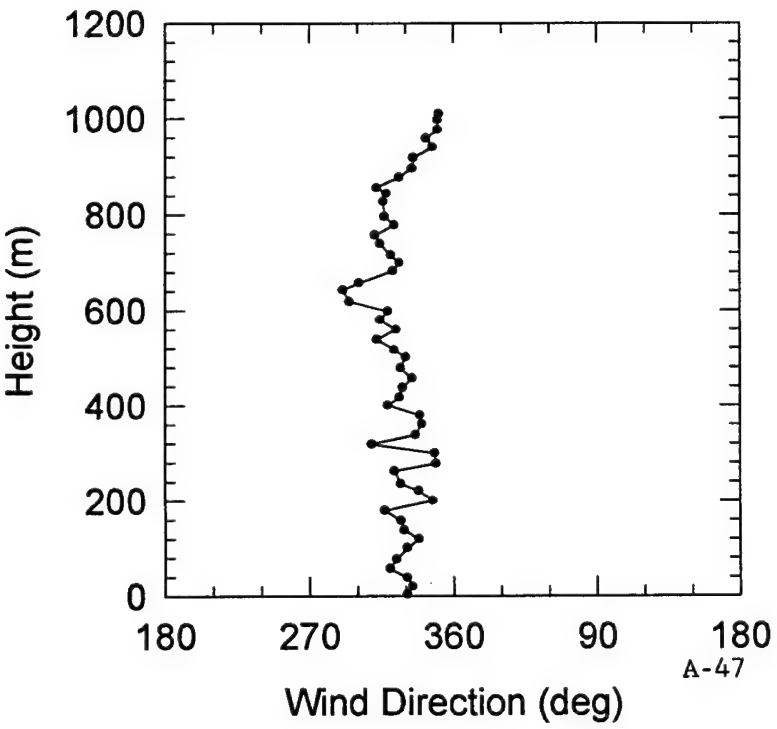
PIBAL DATA - JULIAN DATES 268-269

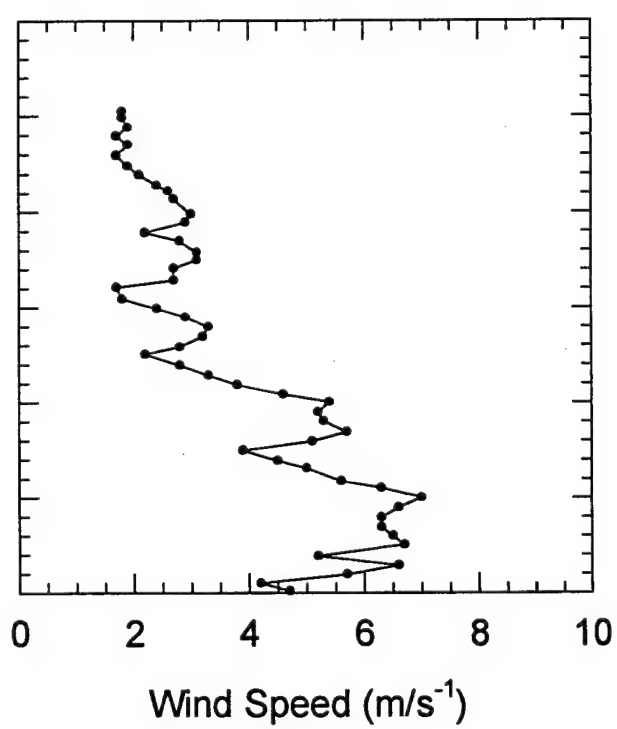


TETHERSONDE DATA - JULIAN DATE 268
2251 UTC

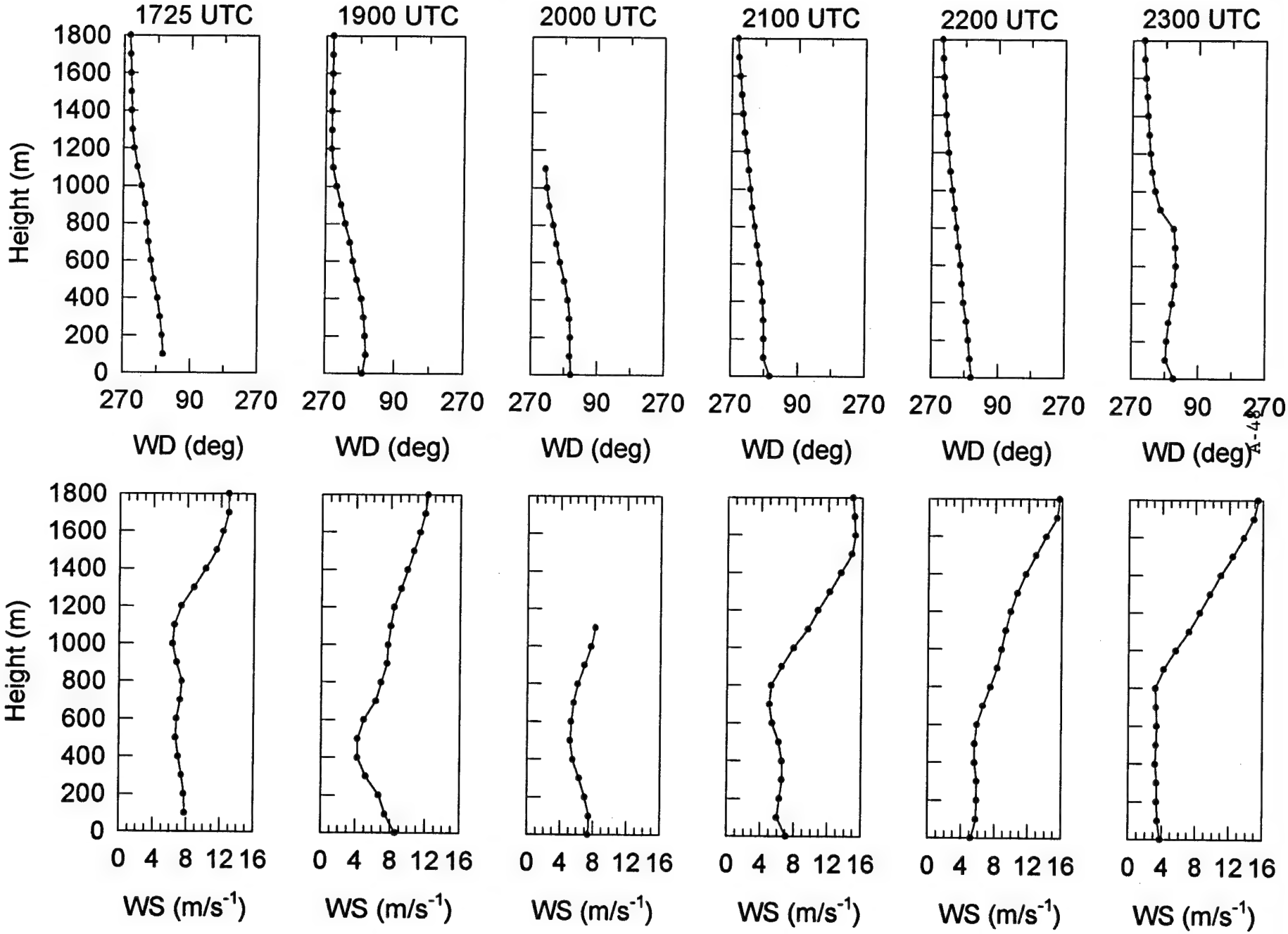




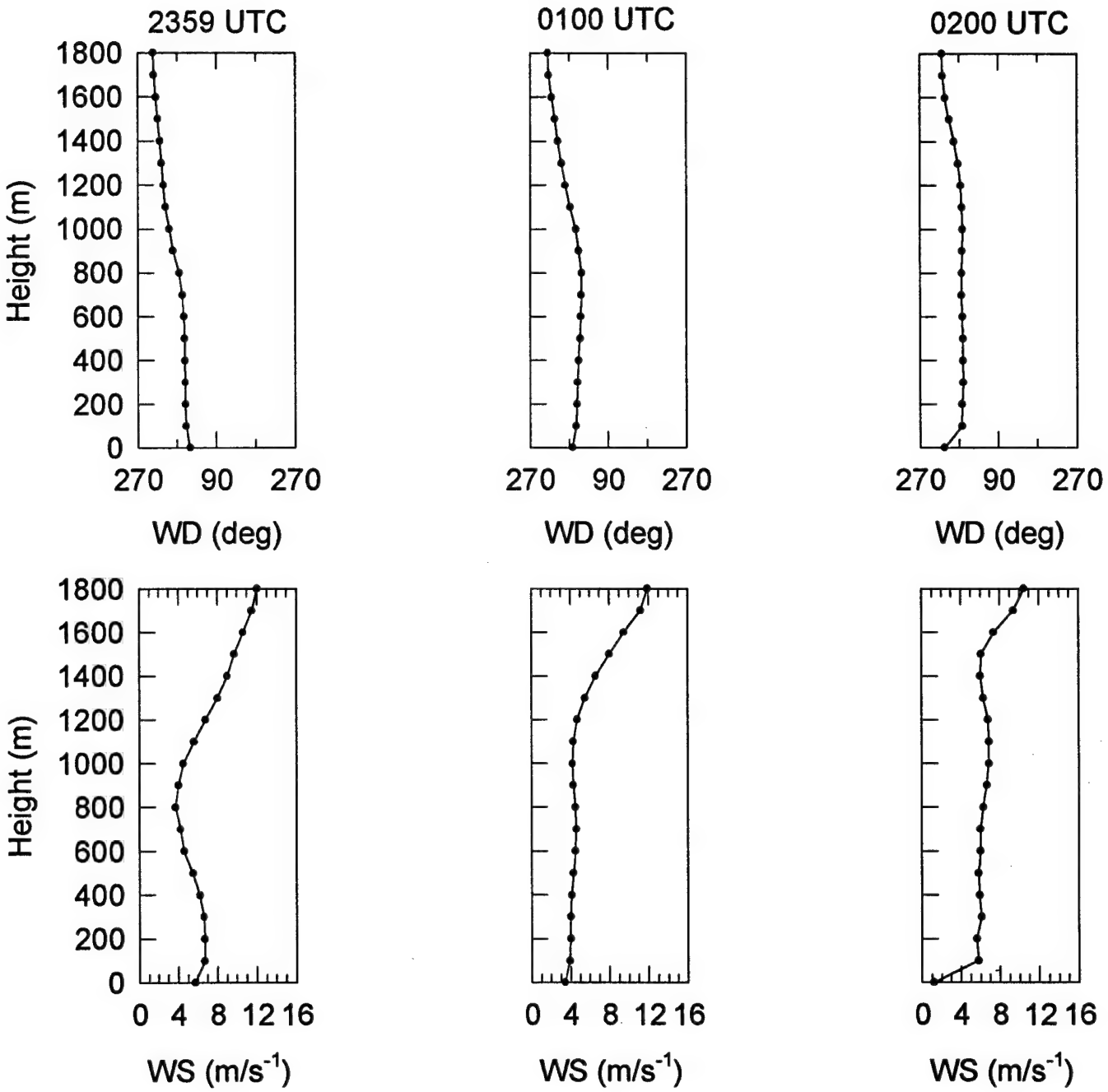


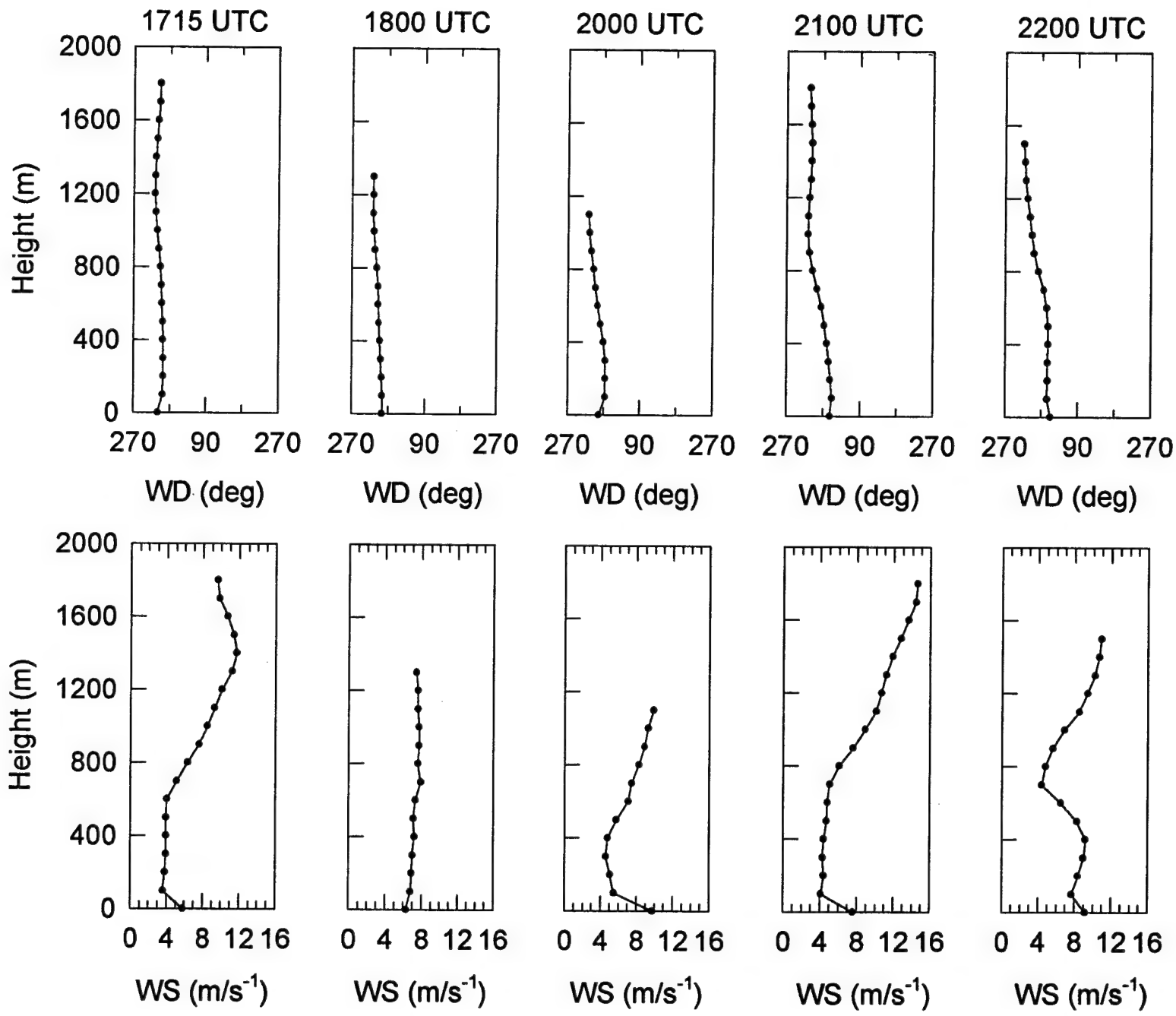


PIBAL DATA - JULIAN DATE 269

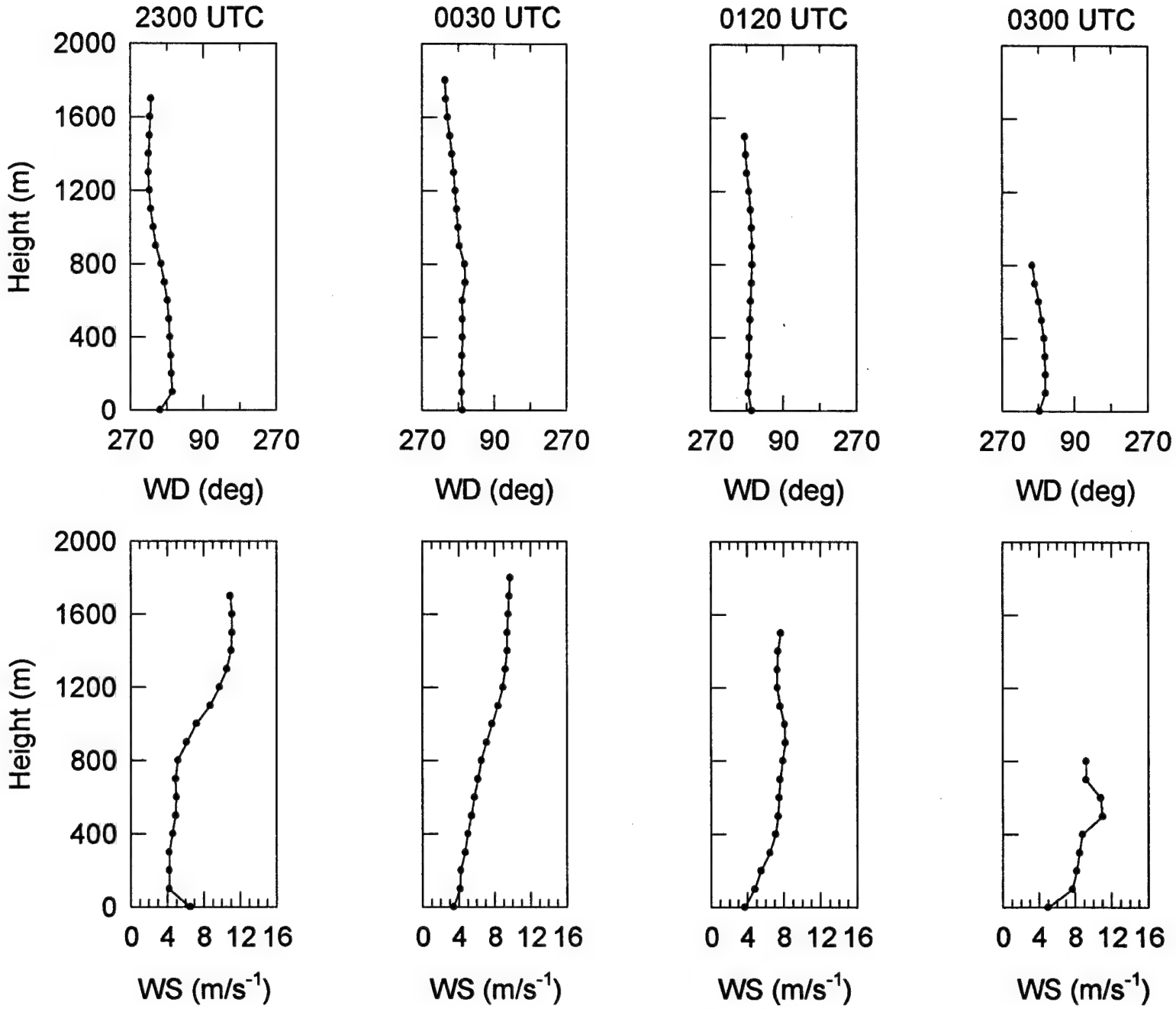


PIBAL DATA - JULIAN DATES 269-270




PIBAL DATA - JULIAN DATE 270
1715 UTC
1800 UTC
2000 UTC
2100 UTC
2200 UTC
Height (m)
2000
1600
1200
800
400
0
270 90 270
WD (deg)
0 4 8 12 16
WS (m/s-1)

PIBAL DATA - JULIAN DATES 270-271



A.2.2 Tabular Data

Pibal and tethersonde flight data are presented in 100-m increments. The pibal flights include only wind direction, wind speed, and north-south (range wind) and east-west (cross wind) components (winds with northerly and easterly components are negative). Additional information available from tethersonde flights includes temperature, humidity, and air density.

METEOROLOGICAL DATA ALOFT DATE: 10 SEP 1996

TEST PROGRAM: DNA TIME: 2000 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS
0.	68.0	0.5	0.0	0.0	
100.	157.5	0.8	0.8	-0.3	
200.	168.9	0.9	0.9	-0.2	
300.	181.9	0.9	0.9	0.0	
400.	215.2	0.7	0.6	0.4	
500.	265.5	0.7	0.1	0.7	
600.	301.3	1.0	-0.5	0.9	
700.	322.3	1.4	-1.1	0.8	
800.	319.5	1.1	-0.8	0.7	
900.	281.0	0.6	-0.1	0.6	
1000.	219.6	0.7	0.5	0.4	
1100.	197.4	1.2	1.1	0.4	

METEOROLOGICAL DATA ALOFT — DATE: 10 SEP 1996

TEST PROGRAM: DNA — TIME: 2100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	345.0	0.9	0.0	0.0
100.	5.6	0.8	-0.8	-0.1
200.	19.1	0.7	-0.7	-0.2
300.	41.1	0.8	-0.6	-0.5
400.	60.5	1.0	-0.5	-0.9
500.	75.8	0.9	-0.2	-0.9
600.	99.7	0.7	0.1	-0.7
700.	165.1	0.8	0.8	-0.2
800.	200.7	1.6	1.5	0.6
900.	206.4	2.4	2.2	1.1
1000.	207.4	2.9	2.6	1.3
1100.	207.9	3.0	2.7	1.4

ESTIMATED HEIGHT OF MIXING DEPTH: 612 METERS

METEOROLOGICAL DATA ALOFT — DATE: 10 SEP 1996

TEST PROGRAM: DNA — TIME: 2200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 0.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 315 METERS
0.	144.0	0.5	0.0	0.0	
100.	25.1	0.9	-0.8	-0.4	
200.	32.4	0.5	-0.4	-0.3	
300.	356.7	0.1	-0.1	0.0	
400.	241.9	0.6	0.3	0.5	
500.	216.1	1.1	0.9	0.6	
600.	217.5	1.5	1.2	0.9	
700.	212.9	2.2	1.9	1.2	
800.	198.6	3.2	3.1	1.0	
900.	196.6	3.9	3.8	1.1	
1000.	190.8	4.5	4.4	0.8	
1100.	186.9	4.9	4.9	0.6	

METEOROLOGICAL DATA ALOFT — DATE: 10 SEP 1996

TEST PROGRAM: DNA — TIME: 2300 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 0.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	287.0	1.2	0.0	0.0
100.	313.3	1.0	-0.7	0.7
200.	275.3	0.7	-0.1	0.6
300.	212.7	1.0	0.9	0.6
400.	196.0	1.9	1.9	0.5
500.	190.3	2.7	2.7	0.5
600.	188.2	3.1	3.1	0.4
700.	186.3	3.2	3.2	0.4
800.	182.9	3.3	3.3	0.2
900.	179.8	3.2	3.2	0.0
1000.	175.1	3.2	3.2	-0.3
1100.	171.2	3.2	3.2	-0.5

ESTIMATED HEIGHT OF MIXING DEPTH: 315 METERS

METEOROLOGICAL DATA ALOFT DATE: 10 SEP 1996

TEST PROGRAM: DNA TIME: 2359 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 0.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	334.0	1.3	0.0	0.0
100.	303.3	3.0	-1.6	2.5
200.	296.4	2.7	-1.2	2.4
300.	280.9	2.2	-0.4	2.2
400.	254.8	2.0	0.5	1.9
500.	229.7	2.4	1.5	1.8
600.	215.1	2.8	2.3	1.6
700.	207.1	3.0	2.7	1.4
800.	198.4	3.4	3.2	1.1
900.	190.3	3.8	3.7	0.7
1000.	184.3	4.1	4.1	0.3
1100.	182.1	4.4	4.4	0.2

ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS

METEOROLOGICAL DATA ALOFT — DATE: 11 SEP 1996

TEST PROGRAM: DNA — TIME: 2000 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	173.0	2.0	---	---
100.	165.5	1.4	1.3	-0.3
200.	174.3	1.4	1.4	-0.1
300.	192.6	1.2	1.2	0.3
400.	219.9	1.0	0.7	0.6
500.	262.9	0.7	0.1	0.7
600.	296.6	0.5	-0.2	0.4
700.	9.7	0.2	-0.2	0.0
800.	85.6	0.4	0.0	-0.4
900.	118.6	0.8	0.4	-0.7
1000.	110.3	1.0	0.3	-0.9
1100.	104.4	1.1	0.3	-1.1

ESTIMATED HEIGHT OF MIXING DEPTH: 612 METERS

METEOROLOGICAL DATA ALOFT — DATE: 11 SEP 1996

TEST PROGRAM: DNA — TIME: 2100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	40.0	1.4	---	---
100.	28.4	1.1	-0.9	-0.5
200.	24.1	1.1	-1.0	-0.5
300.	18.6	1.0	-1.0	-0.3
400.	13.1	1.0	-0.9	-0.2
500.	3.0	0.6	-0.6	0.0
600.	6.3	0.1	-0.1	0.0
700.	110.0	0.2	0.1	-0.2
800.	109.5	0.6	0.2	-0.6
900.	104.7	1.5	0.4	-1.4
1000.	101.8	2.1	0.4	-2.1
1100.	102.8	2.5	0.6	-2.4

ESTIMATED HEIGHT OF MIXING DEPTH: 612 METERS

METEOROLOGICAL DATA ALOFT — DATE: 11 SEP 1996

TEST PROGRAM: DNA — TIME: 2200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	338.0	1.3	---	---
100.	23.3	0.5	-0.5	-0.2
200.	41.4	0.4	-0.3	-0.3
300.	64.9	0.4	-0.2	-0.3
400.	53.5	0.7	-0.4	-0.5
500.	51.4	0.9	-0.6	-0.7
600.	39.8	1.2	-0.9	-0.8
700.	39.0	1.5	-1.1	-0.9
800.	56.7	1.5	-0.8	-1.2
900.	69.8	1.7	-0.6	-1.6
1000.	78.5	1.9	-0.4	-1.9
1100.	83.4	2.0	-0.2	-2.0

ESTIMATED HEIGHT OF MIXING DEPTH: 612 METERS

METEOROLOGICAL DATA ALOFT DATE: 11 SEP 1996

TEST PROGRAM: DNA TIME: 2322 UTC

LOCATION: CAUSEWAY AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	27.7	87.	990.8	330.	2.2	-1.9	1.1
50.	26.8	87.	988.7	357.	3.3	-3.2	0.2
100.	26.5	88.	984.4	4.	4.5	-4.5	-0.3
150.	25.9	88.	981.3	352.	3.4	-3.4	0.5
200.	25.5	88.	977.3	3.	2.7	-2.7	-0.2
250.	25.0	88.	973.5	333.	3.8	-3.4	1.7
300.	24.6	89.	969.4	332.	4.0	-3.5	1.9

ESTIMATED HEIGHT OF MIXING DEPTH: > 350 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 0030 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	24.0	3.0	---	---
100.	22.1	2.9	-2.7	-1.1
200.	22.0	2.9	-2.7	-1.1
300.	26.3	3.0	-2.7	-1.3
400.	33.8	3.2	-2.7	-1.8
500.	41.7	3.7	-2.8	-2.5
600.	51.0	4.2	-2.7	-3.3
700.	55.0	4.4	-2.5	-3.6
800.	57.8	4.4	-2.4	-3.7
900.	60.5	4.0	-2.0	-3.5
1000.	58.9	3.7	-1.9	-3.2
1100.	59.8	3.6	-1.8	-3.1

ESTIMATED HEIGHT OF MIXING DEPTH: 706 METERS

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 0100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
2.	27.0	3.4	---	---
100.	41.9	4.3	-3.2	-2.8
200.	45.0	4.4	-3.1	-3.1
300.	50.7	4.5	-2.8	-3.5
400.	53.9	4.5	-2.6	-3.6
500.	58.9	4.3	-2.2	-3.7
600.	63.5	3.9	-1.7	-3.5
700.	72.0	3.5	-1.1	-3.3
800.	80.8	3.4	-0.5	-3.4
900.	89.4	3.4	0.0	-3.4
1000.	94.9	3.6	0.3	-3.6
1100.	95.7	3.7	0.4	-3.6

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 0200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	79.0	2.8	---	---
100.	77.8	5.3	-1.1	-5.2
200.	78.5	5.2	-1.0	-5.1
300.	82.6	5.0	-0.6	-4.9
400.	84.8	4.6	-0.4	-4.6
500.	87.4	4.3	-0.2	-4.3
600.	91.6	3.8	0.1	-3.8
700.	94.2	3.2	0.2	-3.2
800.	100.6	2.9	0.5	-2.9
900.	107.6	2.7	0.8	-2.5
1000.	113.3	2.7	1.1	-2.5
1100.	116.8	2.8	1.3	-2.5

ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS

METEOROLOGICAL DATA ALOFT DATE: 12 SEP 1996

TEST PROGRAM: DNA TIME: 1930 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1100 METERS
0.	191.0	4.2	---	---	
100.	157.7	3.5	3.2	-1.3	
200.	156.6	3.6	3.3	-1.4	
300.	154.2	3.7	3.3	-1.6	
400.	152.7	4.0	3.5	-1.8	
500.	158.9	4.5	4.2	-1.6	
600.	163.7	5.0	4.8	-1.4	
700.	166.9	5.3	5.2	-1.2	
800.	171.3	5.7	5.6	-0.9	
900.	177.2	6.0	6.0	-0.3	
1000.	181.8	6.3	6.3	0.2	
1100.	185.0	6.6	6.6	0.6	

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 2100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1100 METERS
0.	157.0	3.7	---	---	
100.	153.7	5.8	5.2	-2.6	
200.	151.7	5.8	5.1	-2.8	
300.	148.7	6.2	5.3	-3.2	
400.	146.6	6.4	5.4	-3.5	
500.	148.1	7.0	5.9	-3.7	
600.	151.8	6.8	6.0	-3.2	
700.	154.4	6.0	5.4	-2.6	
800.	157.5	6.0	5.5	-2.3	
900.	159.6	6.0	5.7	-2.1	
1000.	159.3	6.6	6.1	-2.3	
1100.	160.5	7.1	6.7	-2.4	

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 2200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	170.0	6.0	---	---
100.	158.5	8.8	8.2	-3.2
200.	158.1	8.4	7.8	-3.1
300.	157.7	8.1	7.5	-3.1
400.	157.5	7.8	7.2	-3.0
500.	155.5	8.4	7.6	-3.5
600.	154.9	9.0	8.1	-3.8
700.	153.0	9.7	8.7	-4.4
800.	151.2	9.8	8.5	-4.7
900.	149.0	8.7	7.5	-4.5
1000.	146.1	7.9	6.6	-4.4
1100.	144.7	7.1	5.8	-4.1

ESTIMATED HEIGHT OF MIXING DEPTH: 894 METERS

METEOROLOGICAL DATA ALOFT — DATE: 12 SEP 1996

TEST PROGRAM: DNA — TIME: 2300 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 894 METERS
0.	135.0	5.1	---	---	
100.	158.6	6.2	5.8	-2.3	
200.	158.3	6.3	5.8	-2.3	
300.	157.7	6.1	5.7	-2.3	
400.	157.8	5.8	5.3	-2.2	
500.	158.2	6.0	5.6	-2.2	
600.	158.3	6.8	6.3	-2.5	
700.	159.6	8.0	7.5	-2.8	
800.	158.5	9.0	8.3	-3.3	
900.	158.2	8.9	8.3	-3.3	
1000.	157.9	8.3	7.7	-3.1	
1100.	156.7	7.7	7.0	-3.0	

METEOROLOGICAL DATA ALOFT DATE: 12 SEP 1996

TEST PROGRAM: DNA TIME: 2335 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	170.0	6.0	---	---
100.	175.4	10.1	10.0	-0.8
200.	174.7	10.4	10.4	-1.0
300.	173.4	10.8	10.8	-1.2
400.	172.9	10.8	10.7	-1.3
500.	171.6	10.7	10.6	-1.6
600.	170.0	10.0	9.8	-1.7
700.	168.6	9.2	9.1	-1.8
800.	167.6	8.7	8.5	-1.9
900.	167.7	7.9	7.8	-1.7
1000.	169.2	7.7	7.5	-1.4
1100.	170.7	7.8	7.7	-1.3

ESTIMATED HEIGHT OF MIXING DEPTH: 706 METERS

METEOROLOGICAL DATA ALOFT — DATE: 17 SEP 1996

TEST PROGRAM: DNA — TIME: 2050 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1100 METERS
0.	248.0	3.0	---	---	
100.	254.7	2.5	0.7	2.4	
200.	262.2	2.7	0.4	2.7	
300.	269.6	3.2	0.0	3.2	
400.	278.3	3.5	-0.5	3.5	
500.	284.4	3.9	-1.0	3.8	
600.	286.9	3.8	-1.1	3.6	
700.	291.5	3.4	-1.2	3.1	
800.	298.3	3.0	-1.4	2.7	
900.	308.7	2.8	-1.8	2.2	
1000.	318.8	3.0	-2.2	2.0	
1100.	323.9	3.2	-2.6	1.9	

METEOROLOGICAL DATA ALOFT — DATE: 17 SEP 1996

TEST PROGRAM: DNA — TIME: 2200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1100 METERS
0.	258.0	1.6	---	---	
100.	287.0	2.2	-0.7	2.1	
200.	286.3	2.1	-0.6	2.1	
300.	284.3	1.9	-0.5	1.9	
400.	292.1	1.8	-0.7	1.7	
500.	303.2	1.8	-1.0	1.5	
600.	316.2	2.1	-1.5	1.5	
700.	321.3	2.7	-2.1	1.7	
800.	324.0	3.2	-2.6	1.9	
900.	323.0	3.5	-2.8	2.1	
1000.	321.0	3.7	-2.9	2.3	
1100.	320.8	3.7	-2.8	2.3	

METEOROLOGICAL DATA ALOFT — DATE: 17 SEP 1996

TEST PROGRAM: DNA — TIME: 2359 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	35.0	4.0	---	---
100.	31.2	2.4	-2.1	-1.3
200.	22.2	2.4	-2.2	-0.9
300.	5.5	1.9	-1.9	-0.2
400.	346.9	1.8	-1.8	0.4
500.	333.9	1.9	-1.7	0.8
600.	318.1	1.8	-1.3	1.2
700.	309.9	1.8	-1.2	1.4
800.	304.8	2.1	-1.2	1.8
900.	297.7	2.5	-1.2	2.2
1000.	294.8	2.9	-1.2	2.6
1100.	294.0	3.1	-1.3	2.8

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT DATE: 18 SEP 1996

TEST PROGRAM: DNA TIME: 0100 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 315 METERS
0.	334.0	2.3	---	---	
100.	335.0	6.3	-5.7	2.7	
200.	334.6	6.0	-5.4	2.6	
300.	331.5	5.5	-4.9	2.6	
400.	331.7	4.8	-4.2	2.3	
500.	325.2	4.0	-3.3	2.3	
600.	320.0	3.4	-2.6	2.2	
700.	315.1	3.2	-2.3	2.3	
800.	310.2	3.0	-1.9	2.3	
900.	311.2	2.7	-1.8	2.1	
1000.	311.6	2.7	-1.8	2.0	
1100.	313.2	2.6	-1.8	1.9	

METEOROLOGICAL DATA ALOFT — DATE: 18 SEP 1996

TEST PROGRAM: DNA — TIME: 0200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	342.0	3.1	---	---
100.	340.4	3.8	-3.6	1.3
200.	339.9	3.8	-3.5	1.3
300.	339.6	3.8	-3.5	1.3
400.	340.1	3.7	-3.5	1.3
500.	342.2	3.8	-3.6	1.2
600.	344.0	3.9	-3.8	1.1
700.	343.7	4.1	-4.0	1.2
800.	343.1	4.2	-4.0	1.2
900.	340.2	4.2	-3.9	1.4
1000.	338.2	4.2	-3.9	1.6
1100.	337.3	4.1	-3.8	1.6

ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS

METEOROLOGICAL DATA ALOFT DATE: 18 SEP 1996

TEST PROGRAM: DNA TIME: 0300 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS
0.	295.0	4.2	---	---	
100.	318.4	3.7	-2.8	2.5	
200.	325.6	3.8	-3.2	2.2	
300.	340.5	4.0	-3.8	1.3	
400.	352.5	4.2	-4.2	0.5	
500.	353.5	4.2	-4.2	0.5	
600.	358.2	4.0	-4.0	0.1	

METEOROLOGICAL DATA ALOFT DATE: 19 SEP 1996

TEST PROGRAM: DNA TIME: 2000 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 706 METERS
0.	167.0	2.9	---	---	
100.	155.4	2.8	2.5	-1.1	
200.	151.0	2.5	2.2	-1.2	
300.	147.0	2.0	1.7	-1.1	
400.	142.7	1.5	1.2	-0.9	
500.	145.9	1.2	1.0	-0.7	
600.	169.9	0.7	0.7	-0.1	
700.	228.4	0.9	0.6	0.7	
800.	253.0	1.6	0.5	1.5	
900.	263.9	2.6	0.3	2.6	
1000.	264.1	3.3	0.3	3.3	
1100.	265.9	3.6	0.3	3.5	

METEOROLOGICAL DATA ALOFT DATE: 19 SEP 1996

TEST PROGRAM: DNA TIME: 2100 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	151.0	3.3	---	---
100.	139.8	2.5	1.9	-1.6
200.	143.6	2.6	2.1	-1.6
300.	144.5	2.6	2.1	-1.5
400.	149.1	2.6	2.3	-1.4
500.	153.6	2.5	2.2	-1.1
600.	153.5	2.3	2.0	-1.0
700.	158.4	2.0	1.9	-0.7
800.	167.3	1.9	1.9	-0.4
900.	193.5	1.7	1.6	0.4
1000.	222.7	1.9	1.4	1.3
1100.	237.1	2.3	1.3	1.9

ESTIMATED HEIGHT OF MIXING DEPTH: 894 METERS

METEOROLOGICAL DATA ALOFT DATE: 19 SEP 1996

TEST PROGRAM: DNA TIME: 2141 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	18.0	32.	1040.1	82.	1.2	-0.2	-1.2

ESTIMATED HEIGHT OF MIXING DEPTH: > 40 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 19 SEP 1996

TEST PROGRAM: DNA TIME: 2157 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	17.5	MMM	1040.1	25.	1.7	-1.5	-0.7
50.	17.2	MMM	1035.4	45.	2.7	-1.9	-1.9
100.	16.4	MMM	1032.0	37.	-2.9	2.3	1.7

ESTIMATED HEIGHT OF MIXING DEPTH: > 105 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 19 SEP 1996

TEST PROGRAM: DNA TIME: 2220 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 0.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	17.8	MMM	1039.8	34.	3.7	-3.1	-2.1
50.	16.8	MMM	1037.3	34.	3.8	-3.1	-2.1
100.	16.5	MMM	1032.3	44.	3.5	-2.5	-2.4
150.	15.9	MMM	1028.4	38.	3.1	-2.4	-1.9
200.	15.5	MMM	1023.8	39.	3.7	-2.9	-2.3
250.	15.0	MMM	1019.8	25.	4.6	-4.2	-2.0
300.	14.6	MMM	1015.1	343.	4.3	-4.1	1.2
350.	14.0	MMM	1011.4	12.	4.2	-4.1	-0.9
400.	13.6	MMM	1006.8	335.	4.1	-3.7	1.7
450.	13.2	MMM	1002.4	359.	4.4	-4.4	0.1
500.	12.7	MMM	998.1	3.	3.7	-3.7	-0.2
550.	12.2	MMM	994.0	16.	3.7	-3.6	-1.1
600.	11.7	MMM	989.9	47.	4.1	-2.8	-3.0
650.	11.3	MMM	985.4	12.	3.4	-3.3	-0.7
700.	11.0	MMM	980.8	351.	1.9	-1.9	0.3
750.	10.5	MMM	976.7	35.	3.0	-2.4	-1.7
800.	10.2	MMM	971.8	48.	2.5	-1.7	-1.8
850.	9.6	MMM	968.2	60.	1.9	-1.0	-1.7
900.	9.0	MMM	964.1	347.	1.6	-1.5	0.4
950.	8.7	MMM	959.5	332.	1.3	-1.2	0.6

ESTIMATED HEIGHT OF MIXING DEPTH: 984 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 20 SEP 1996

TEST PROGRAM: DNA TIME: 0000 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS
0.	62.0	5.8	---	---	
100.	50.8	6.2	-3.9	-4.8	
200.	54.4	5.5	-3.2	-4.5	
300.	64.0	3.8	-1.7	-3.4	
400.	88.0	2.3	-0.1	-2.3	
500.	130.5	2.2	1.5	-1.7	
600.	161.2	2.9	2.7	-0.9	
700.	170.4	3.5	3.5	-0.6	
800.	170.8	4.1	4.0	-0.6	
900.	172.1	4.4	4.3	-0.6	
1000.	170.7	4.5	4.4	-0.7	
1100.	170.4	4.5	4.4	-0.7	

METEOROLOGICAL DATA ALOFT DATE: 20 SEP 1996

TEST PROGRAM: DNA TIME: 0100 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	15.8	MMM	1046.8	12.	5.7	-5.6	-1.2
50.	15.2	MMM	1043.0	14.	5.7	-5.5	-1.4
100.	14.5	MMM	1039.3	15.	6.3	-6.0	-1.6
150.	14.1	MMM	1034.5	20.	6.3	-5.9	-2.1
200.	13.8	MMM	1029.6	25.	6.4	-5.8	-2.7
250.	13.3	MMM	1025.4	28.	6.6	-5.8	-3.1
300.	13.0	MMM	1020.5	29.	6.2	-5.4	-3.0
350.	12.8	MMM	1015.2	41.	5.1	-3.9	-3.3
400.	12.4	MMM	1010.6	44.	4.3	-3.1	-2.9
450.	12.1	MMM	1005.7	52.	3.4	-2.1	-2.6
500.	11.8	MMM	1001.0	64.	3.1	-1.3	-2.7
550.	11.4	MMM	996.4	82.	2.6	-0.4	-2.5
600.	10.9	MMM	992.1	101.	2.5	0.5	-2.4
650.	10.5	MMM	987.6	98.	2.2	0.3	-2.2
700.	10.0	MMM	983.3	88.	2.4	-0.1	-2.4
750.	9.6	MMM	979.0	81.	1.9	-0.3	-1.9
800.	9.2	MMM	974.6	101.	1.6	0.3	-1.6
850.	8.8	MMM	970.2	84.	1.4	-0.1	-1.4
900.	8.4	MMM	965.5	108.	1.3	0.4	-1.2
950.	8.0	MMM	961.0	170.	1.5	1.5	-0.3

ESTIMATED HEIGHT OF MIXING LAYER: 542 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 20 SEP 1996

TEST PROGRAM: DNA TIME: 0135 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	15.2	MMM	1049.7	9.	5.2	-5.1	-0.8
50.	14.8	MMM	1044.9	19.	5.6	-5.3	-1.8
100.	14.2	MMM	1041.0	27.	7.4	-6.6	-3.3

ESTIMATED HEIGHT OF MIXING DEPTH: > 150 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT — DATE: 21 SEP 1996

TEST PROGRAM: DNA — TIME: 1720 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	170.0	2.5	---	---
100.	148.6	0.8	0.7	-0.4
200.	117.3	0.7	0.3	-0.6
300.	53.9	1.2	-0.7	-0.9
400.	34.5	1.8	-1.5	-1.0
500.	22.5	1.7	-1.5	-0.6
600.	326.7	1.2	-1.0	0.6
700.	267.4	2.4	0.1	2.4
800.	253.0	4.1	1.2	3.9
900.	250.0	5.7	1.9	5.3
1000.	249.2	6.2	2.2	5.8
1100.	247.8	6.5	2.4	6.0
1200.	246.4	6.6	2.7	6.1
1300.	244.5	6.6	2.8	5.9
1400.	243.0	6.5	3.0	5.8
1500.	241.4	6.4	3.1	5.7

ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS

METEOROLOGICAL DATA ALOFT DATE: 21 SEP 1996

TEST PROGRAM: DNA TIME: 1800 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	132.0	0.3	---	---
100.	181.3	0.6	0.6	0.0
200.	146.4	0.7	0.6	-0.4
300.	120.5	1.3	0.6	-1.1
400.	118.5	1.8	0.8	-1.5
500.	131.1	1.7	1.1	-1.3
600.	163.5	1.6	1.5	-0.4
700.	206.5	2.2	1.9	1.0
800.	224.5	3.3	2.3	2.3
900.	233.3	4.4	2.6	3.5
1000.	236.7	5.3	2.9	4.4
1100.	239.4	5.9	3.0	5.1
1200.	242.3	6.4	3.0	5.6
1300.	245.2	6.7	2.8	6.1
1400.	246.9	7.0	2.7	6.4
1500.	248.4	7.3	2.7	6.7

ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS

METEOROLOGICAL DATA ALOFT — DATE: 21 SEP 1996

TEST PROGRAM: DNA — TIME: 1900 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	127.0	0.1	---	---
100.	89.2	1.0	0.0	-1.0
200.	108.7	1.1	0.3	-1.0
300.	140.1	1.1	0.9	-0.7
400.	173.8	1.9	1.9	-0.2
500.	184.3	3.0	3.0	0.2
600.	190.6	3.8	3.8	0.7
700.	196.1	4.5	4.3	1.2
800.	201.9	4.7	4.3	1.7
900.	210.6	4.9	4.2	2.5
1000.	217.8	5.2	4.1	3.2
1100.	223.5	5.1	3.7	3.5
1200.	230.8	5.0	3.1	3.9
1300.	242.2	5.3	2.5	4.7
1400.	248.5	5.8	2.1	5.4
1500.	252.0	6.6	2.0	6.3

ESTIMATED HEIGHT OF MIXING DEPTH: 1170 METERS

METEOROLOGICAL DATA ALOFT DATE: 21 SEP 1996

TEST PROGRAM: DNA TIME: 2000 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 315 METERS
0.	65.0	1.5	---	---	
100.	30.2	1.1	-1.0	-0.6	
200.	32.6	0.8	-0.7	-0.5	
300.	140.0	0.3	0.2	-0.2	
400.	180.0	1.3	1.3	0.0	
500.	181.5	2.6	2.6	0.1	
600.	186.5	3.7	3.7	0.4	
700.	195.9	4.3	4.1	1.2	
800.	205.7	4.9	4.4	2.1	
900.	219.2	5.5	4.3	3.5	
1000.	226.7	6.1	4.2	4.5	
1100.	230.0	6.4	4.1	4.9	
1200.	232.5	6.6	4.0	5.3	
1300.	234.8	6.7	3.9	5.5	
1400.	236.6	6.8	3.8	5.7	
1500.	239.3	7.0	3.6	6.0	

METEOROLOGICAL DATA ALOFT DATE: 21 SEP 1996

TEST PROGRAM: DNA TIME: 2055 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	23.6	34.	1011.4	20.	4.9	-4.6	-1.7
50.	22.9	34.	1008.3	19.	3.5	-3.3	-1.2
100.	22.5	34.	1003.9	36.	3.1	-2.5	-1.8
150.	22.1	35.	999.7	22.	3.4	-3.2	-1.3
200.	21.7	35.	995.0	5.	3.7	-3.7	-0.3
250.	21.3	35.	990.5	44.	4.0	-2.9	-2.7
300.	21.0	36.	986.1	73.	2.5	-0.7	-2.3
350.	20.6	36.	981.7	89.	2.1	0.0	-2.1
400.	20.2	36.	977.2	74.	2.3	-0.6	-2.2
450.	20.0	37.	972.4	115.	2.2	0.9	-2.0
500.	19.6	39.	967.9	95.	3.6	0.3	-3.5
550.	19.3	39.	963.4	81.	2.3	-0.4	-2.3
600.	19.0	40.	958.8	82.	2.8	-0.4	-2.8
650.	18.7	40.	954.1	86.	3.7	-0.3	-3.7
700.	18.4	41.	949.4	104.	4.6	1.1	-4.4
750.	18.2	41.	944.6	134.	5.5	3.8	-4.0
800.	17.9	41.	940.1	132.	6.3	4.2	-4.7
850.	17.6	42.	935.5	144.	7.1	5.7	-4.1
900.	17.3	43.	931.1	153.	7.6	6.8	-3.4
950.	17.0	43.	926.8	154.	7.8	7.1	-3.4
1000.	16.9	42.	921.8	160.	8.4	7.9	-2.9
1050.	16.6	42.	917.3	172.	9.2	9.1	-1.3
1100.	16.3	42.	913.0	172.	9.2	9.1	-1.3
1150.	16.0	42.	908.6	177.	9.0	9.0	-0.5
1200.	15.5	43.	904.7	182.	8.2	8.2	0.3

ESTIMATED HEIGHT OF MIXING DEPTH: 260 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 22 SEP 1996

TEST PROGRAM: DNA TIME: 0235 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	23.1	38.	1008.9	294.	5.9	-2.4	5.4
50.	23.3	36.	1002.6	290.	7.6	-2.6	7.1
100.	23.0	36.	998.0	302.	7.3	-3.8	6.2
150.	22.8	36.	993.3	303.	6.5	-3.5	5.4
200.	22.6	36.	988.2	309.	5.9	-3.7	4.6
250.	22.4	36.	983.0	315.	5.0	-3.5	3.5
300.	22.7	34.	976.6	323.	3.3	-2.7	2.0
350.	23.1	33.	969.7	343.	1.7	-1.7	0.5
400.	23.0	33.	964.4	357.	1.1	-1.1	0.0
450.	22.7	33.	959.9	5.	1.0	-1.0	-0.1
500.	22.3	33.	955.7	96.	0.7	0.6	-0.7

ESTIMATED HEIGHT OF MIXING DEPTH: 55 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 22 SEP 1996

TEST PROGRAM: DNA TIME: 0430 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: < 108 METERS
0.	357.0	2.2	---	---	
100.	352.0	4.8	-4.8	0.7	
200.	341.7	4.2	-4.0	1.3	
300.	324.0	3.8	-3.1	2.2	
400.	301.4	4.0	-2.1	3.4	
500.	291.4	5.2	-1.9	4.9	
600.	292.8	6.1	-2.3	5.6	
700.	293.3	6.4	-2.5	5.9	
800.	294.9	6.6	-2.8	6.0	
900.	290.9	6.4	-2.3	6.0	
1000.	288.0	6.2	-1.9	5.9	
1100.	286.4	6.0	-1.7	5.8	
1200.	283.8	5.6	-1.3	5.4	
1300.	278.7	5.0	-0.8	4.9	
1400.	269.8	4.5	0.0	4.5	
1500.	257.1	4.4	1.0	4.3	
1600.	246.0	4.9	2.0	4.5	
1700.	238.5	5.8	3.1	5.0	
1800.	237.4	6.3	3.4	5.3	

METEOROLOGICAL DATA ALOFT DATE: 23 SEP 1996

TEST PROGRAM: DNA TIME: 1715 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	347.0	5.0	---	---
100.	342.8	5.1	-4.9	1.5
200.	343.9	4.9	-4.7	1.4
300.	348.1	4.2	-4.1	0.9
400.	356.1	3.2	-3.2	0.2
500.	9.4	1.9	-1.9	-0.3
600.	58.4	1.0	-0.5	-0.9
700.	114.9	1.6	0.7	-1.5
800.	147.7	2.6	2.2	-1.4
900.	168.2	3.7	3.6	-0.8
1000.	179.5	4.9	4.9	0.0
1100.	187.5	5.7	5.6	0.7

ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS

METEOROLOGICAL DATA ALOFT — DATE: 23 SEP 1996

TEST PROGRAM: DNA — TIME: 1800 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	341.0	4.9	---	---
100.	346.2	4.6	-4.4	1.1
200.	347.1	4.5	-4.4	1.0
300.	348.6	4.2	-4.1	0.8
400.	351.6	2.9	-2.8	0.4
500.	4.0	0.8	-0.8	-0.1
600.	149.4	1.3	1.1	-0.7
700.	159.7	3.0	2.9	-1.1
800.	163.5	4.0	3.8	-1.1
900.	173.0	4.8	4.7	-0.6
1000.	182.2	5.8	5.8	0.2
1100.	190.0	6.7	6.6	1.2
1200.	196.2	7.5	7.2	2.1
1300.	205.2	8.0	7.3	3.4
1400.	213.2	8.3	6.9	4.5
1500.	221.2	8.2	6.2	5.4
1600.	226.1	7.7	5.4	5.6
1700.	230.1	7.0	4.5	5.4
1800.	230.5	6.8	4.3	5.3

ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS

METEOROLOGICAL DATA ALOFT DATE: 23 SEP 1996

TEST PROGRAM: DNA TIME: 1900 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS
0.	350.0	3.9	---	---	
100.	350.5	4.4	-4.3	0.7	
200.	348.6	4.2	-4.1	0.8	
300.	347.5	3.1	-3.0	0.7	
400.	352.1	1.2	-1.2	0.2	
500.	122.3	0.5	0.3	-0.4	
600.	157.0	2.2	2.1	-0.9	
700.	169.5	3.4	3.4	-0.6	
800.	178.9	4.6	4.6	-0.1	
900.	186.4	5.4	5.4	0.6	
1000.	191.7	6.0	5.9	1.2	
1100.	199.8	6.6	6.2	2.2	
1200.	208.8	6.8	6.0	3.3	
1300.	219.8	7.1	5.4	4.5	
1400.	229.0	7.0	4.6	5.3	
1500.	238.2	6.5	3.4	5.5	
1600.	241.1	6.5	3.1	5.7	
1700.	240.6	6.6	3.2	5.8	
1800.	240.0	6.9	3.4	5.9	

METEOROLOGICAL DATA ALOFT — DATE: 23 SEP 1996

TEST PROGRAM: DNA — TIME: 2000 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	336.0	3.2	---	---
100.	353.5	3.4	-3.4	0.4
200.	358.3	3.4	-3.4	0.1
300.	2.9	2.7	-2.7	-0.1
400.	22.6	1.6	-1.5	-0.6
500.	108.7	0.7	0.2	-0.7
600.	161.7	2.4	2.3	-0.8
700.	167.2	3.4	3.3	-0.8
800.	176.1	4.6	4.5	-0.3
900.	183.1	5.5	5.5	0.3
1000.	190.9	6.3	6.1	1.2
1100.	198.6	7.2	6.9	2.3
1200.	205.7	7.5	6.7	3.2
1300.	215.6	7.0	5.7	4.1
1400.	225.5	6.3	4.4	4.5
1500.	236.4	5.5	3.1	4.6
1600.	242.6	5.9	2.7	5.2
1700.	245.0	6.6	2.8	6.0
1800.	245.4	7.3	3.0	6.6

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT DATE: 23 SEP 1996

TEST PROGRAM: DNA TIME: 2055 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	15.5	42.	1049.7	355.	1.7	-1.7	0.1
50.	15.0	43.	1045.2	322.	2.6	-2.0	1.6
100.	14.5	44.	1040.9	335.	3.8	-3.5	1.6
150.	14.1	43.	1036.2	339.	2.5	-2.4	0.9
200.	13.7	44.	1031.6	336.	2.4	-2.2	1.0
250.	13.3	45.	1026.9	336.	2.5	-2.3	1.0
300.	12.9	45.	1022.5	348.	2.5	-2.4	0.5
350.	12.5	45.	1017.7	321.	1.9	-1.5	1.2
400.	12.1	46.	1013.3	17.	2.1	-2.0	-0.6
450.	11.6	47.	1008.9	353.	3.4	-3.4	0.4
500.	11.3	47.	1003.9	55.	3.0	-1.7	-2.5

ESTIMATED HEIGHT OF MIXING DEPTH: 446 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 23 SEP 1996

TEST PROGRAM: DNA TIME: 2204 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	16.9	42.	1044.0	343.	2.9	-2.8	0.8
50.	16.2	41.	1040.5	336.	2.7	-2.5	1.1
100.	15.8	41.	1035.9	356.	2.1	-2.1	0.1
150.	15.3	41.	1031.6	347.	1.7	-1.6	0.4
200.	14.9	42.	1027.2	348.	2.3	-2.2	0.5
250.	14.4	43.	1022.9	348.	3.1	-3.0	0.6
300.	13.9	43.	1018.5	325.	3.0	-2.5	1.7
350.	13.6	43.	1013.7	336.	2.6	-2.3	1.0
400.	13.1	44.	1009.2	27.	2.3	-2.1	-1.1
450.	12.8	44.	1004.5	343.	2.3	-2.2	0.7
500.	12.6	45.	999.3	37.	2.1	-1.7	-1.3
550.	12.6	45.	993.3	64.	1.9	-0.8	-1.7
600.	12.5	46.	987.7	95.	2.6	0.2	-2.6
650.	12.4	49.	982.0	107.	3.2	0.9	-3.1
700.	12.3	50.	976.5	115.	3.6	1.5	-3.3
750.	12.0	52.	971.4	122.	4.0	2.1	-3.4
800.	12.1	54.	965.3	140.	4.7	3.6	-3.0
850.	12.0	55.	959.8	140.	5.5	4.2	-3.5
900.	11.8	56.	954.8	133.	5.8	3.9	-4.2
950.	11.3	56.	950.7	126.	5.5	3.2	-4.5
1000.	11.0	57.	946.1	141.	6.3	4.9	-4.0
1050.	11.0	58.	940.3	147.	6.9	5.8	-3.8

ESTIMATED HEIGHT OF MIXING DEPTH: 470 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 23 SEP 1996

TEST PROGRAM: DNA TIME: 2303 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	17.7	41.	1038.5	316.	4.6	-3.3	3.2
50.	16.9	42.	1035.1	305.	4.5	-2.6	3.7
100.	16.6	42.	1030.2	307.	5.1	-3.1	4.1
150.	16.1	42.	1026.2	322.	4.5	-3.5	2.8
200.	15.6	42.	1022.1	334.	4.1	-3.7	1.8
250.	15.2	42.	1017.6	330.	3.8	-3.3	1.9
300.	14.8	43.	1012.9	329.	3.9	-3.4	2.0
350.	14.4	44.	1008.2	327.	4.5	-3.7	2.5
400.	13.9	45.	1004.0	347.	4.3	-4.2	1.0
450.	13.5	45.	999.7	343.	3.6	-3.4	1.0
500.	13.2	45.	994.8	348.	2.7	-2.6	0.5
550.	12.9	46.	989.9	3.	2.6	-2.6	-0.1
600.	12.7	46.	984.6	19.	2.3	-2.2	-0.8
650.	12.9	46.	977.9	59.	2.1	-1.1	-1.8
700.	13.1	48.	971.4	103.	3.3	0.7	-3.3
750.	13.0	49.	965.8	96.	4.0	0.4	-4.0
800.	12.8	51.	960.6	102.	4.6	1.0	-4.5
850.	12.7	53.	955.2	122.	5.3	2.8	-4.5
900.	12.7	53.	949.6	144.	5.0	4.0	-2.9

ESTIMATED HEIGHT OF MIXING DEPTH: 424 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 24 SEP 1996

TEST PROGRAM: DNA TIME: 0050 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	18.6	39.	1036.0	320.	4.6	-3.5	2.9
50.	17.9	40.	1032.4	307.	6.3	-3.8	5.0
100.	17.3	42.	1028.5	337.	6.1	-5.6	2.3
150.	16.8	42.	1024.4	331.	6.0	-5.3	2.9
200.	16.3	43.	1020.2	340.	6.2	-5.8	2.1
250.	15.9	43.	1015.7	338.	6.1	-5.6	2.3
300.	15.4	44.	1011.4	333.	5.9	-5.3	2.7
350.	14.9	44.	1007.2	323.	5.2	-4.1	3.1
400.	14.5	44.	1002.9	328.	5.1	-4.3	2.7
450.	14.2	45.	998.0	341.	4.9	-4.7	1.6
500.	13.8	45.	993.3	10.	4.5	-4.5	-0.8
550.	13.4	46.	989.0	360.	4.2	-4.2	0.0
600.	13.3	47.	983.3	32.	4.7	-4.0	-2.5
650.	13.1	48.	978.1	41.	4.7	-3.6	-3.1
700.	13.2	48.	972.0	68.	4.2	-1.5	-3.9
750.	13.2	48.	966.3	86.	2.6	-0.2	-2.6
800.	13.0	48.	961.3	92.	2.3	0.1	-2.3
850.	12.8	48.	956.1	110.	3.0	1.0	-2.9
900.	12.8	49.	950.3	107.	3.5	1.0	-3.4
950.	13.0	49.	944.0	114.	4.7	1.9	-4.3
1000.	12.7	50.	939.3	119.	5.0	2.4	-4.4

ESTIMATED HEIGHT OF MIXING DEPTH: 239 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT DATE: 24 SEP 1996

TEST PROGRAM: DNA TIME: 0227 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	16.8	41.	1041.3	331.	5.8	-5.1	2.8
50.	16.5	41.	1036.2	322.	7.6	-5.9	4.7
100.	16.1	42.	1031.7	325.	7.8	-6.4	4.5
150.	15.6	42.	1027.4	323.	7.2	-5.8	4.4
200.	15.3	43.	1022.7	323.	6.8	-5.4	4.1
250.	14.9	43.	1018.0	325.	6.4	-5.2	3.7
300.	14.6	43.	1013.2	326.	5.9	-4.9	3.3
350.	14.4	43.	1007.6	338.	5.1	-4.7	1.9
400.	14.5	43.	1001.4	355.	4.5	-4.5	0.4
450.	14.4	44.	995.8	11.	4.8	-4.7	-0.9

ESTIMATED HEIGHT OF MIXING DEPTH: 104 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT — DATE: 24 SEP 1996

TEST PROGRAM: DNA — TIME: 1745 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	79.0	1.4	---	---
100.	71.8	1.8	-0.6	-1.7
200.	72.0	1.8	-0.5	-1.7
300.	64.3	1.5	-0.7	-1.4
400.	59.4	0.9	-0.5	-0.8
500.	208.4	0.3	0.2	0.1
600.	227.2	1.4	1.0	1.1
700.	221.9	2.7	2.0	1.8
800.	221.1	4.3	3.2	2.8
900.	230.0	5.3	3.4	4.0
1000.	238.8	6.2	3.2	5.3
1100.	248.9	6.6	2.4	6.1
1200.	256.2	6.6	1.6	6.4
1300.	255.3	6.8	1.7	6.6
1400.	254.7	7.3	1.9	7.0
1500.	254.3	8.0	2.2	7.7
1600.	255.9	8.1	2.0	7.9
1700.	258.4	8.0	1.6	7.9
1800.	259.0	7.8	1.5	7.7

ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS

METEOROLOGICAL DATA ALOFT DATE: 24 SEP 1996

TEST PROGRAM: DNA TIME: 1900 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS
0.	54.0	1.7	---	---	
100.	49.0	1.8	-1.2	-1.3	
200.	54.5	1.5	-0.9	-1.3	
300.	73.0	0.9	-0.2	-0.8	
400.	177.1	1.1	1.1	-0.1	
500.	198.4	2.3	2.1	0.7	
600.	207.9	3.8	3.3	1.8	
700.	214.9	4.6	3.8	2.6	
800.	224.5	4.4	3.1	3.1	
900.	239.4	4.8	2.4	4.1	
1000.	253.6	4.8	1.4	4.6	
1100.	262.0	5.4	0.8	5.3	
1200.	263.9	6.1	0.7	6.1	
1300.	263.8	6.6	0.7	6.6	
1400.	262.7	7.0	0.9	7.0	
1500.	260.7	7.2	1.2	7.1	
1600.	258.1	7.6	1.6	7.4	
1700.	255.5	8.0	2.0	7.7	
1800.	254.8	8.1	2.1	7.8	

METEOROLOGICAL DATA ALOFT — DATE: 24 SEP 1996

TEST PROGRAM: DNA — TIME: 2000 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	356.0	2.3	---	---
100.	21.3	2.3	-2.1	-0.8
200.	28.7	1.9	-1.7	-0.9
300.	59.2	1.4	-0.7	-1.2
400.	99.1	1.1	0.2	-1.0
500.	161.0	1.2	1.2	-0.4
600.	197.7	2.4	2.3	0.7
700.	216.1	3.3	2.6	1.9
800.	226.9	3.7	2.5	2.7
900.	240.6	3.9	1.9	3.4
1000.	254.0	3.7	1.0	3.6
1100.	261.1	4.4	0.7	4.4
1200.	263.0	5.3	0.6	5.3
1300.	262.2	6.2	0.8	6.2
1400.	259.6	6.8	1.2	6.7
1500.	255.5	7.2	1.8	7.0
1600.	252.1	7.4	2.3	7.1
1700.	249.1	7.6	2.7	7.1
1800.	248.4	7.6	2.8	7.1

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT DATE: 24 SEP 1996

TEST PROGRAM: DNA TIME: 2100 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS
0.	356.0	2.3	---	---	
100.	4.5	2.3	-2.3	-0.2	
200.	14.3	2.3	-2.2	-0.6	
300.	36.3	2.1	-1.7	-1.2	
400.	61.4	1.7	-0.8	-1.5	
500.	107.8	1.6	0.5	-1.5	
600.	153.0	1.9	1.7	-0.8	
700.	186.3	2.3	2.3	0.3	
800.	202.2	2.7	2.5	1.0	
900.	214.5	2.3	1.9	1.3	
1000.	221.9	1.9	1.4	1.3	
1100.	226.8	1.5	1.0	1.1	
1200.	227.6	1.5	1.0	1.1	
1300.	226.0	1.9	1.3	1.4	
1400.	230.3	2.3	1.5	1.8	
1500.	237.2	2.9	1.6	2.5	
1600.	246.4	4.1	1.6	3.7	
1700.	252.5	5.6	1.7	5.3	
1800.	254.0	6.3	1.7	6.0	

METEOROLOGICAL DATA ALOFT DATE: 24 SEP 1996

TEST PROGRAM: DNA TIME: 2251 UTC

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.00 (DEG)

HEIGHT AGL (M)	TEMP (C)	REL HUMID (PCT)	AIR DENSITY (G/M3)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	23.0	35.	1016.4	330.	5.5	-4.8	2.8
50.	22.2	36.	1013.2	324.	5.7	-4.6	3.3
100.	21.8	37.	1008.9	337.	5.7	-5.2	2.2
150.	21.3	37.	1004.9	334.	6.2	-5.6	2.7
200.	20.8	37.	1001.0	346.	6.9	-6.7	1.7
250.	20.4	37.	996.5	334.	5.4	-4.9	2.4
300.	20.1	37.	992.0	347.	4.0	-3.9	0.9
350.	19.6	38.	987.8	334.	5.3	-4.8	2.3
400.	19.1	38.	983.6	329.	5.1	-4.4	2.7
450.	18.7	39.	979.5	329.	3.4	-2.9	1.7
500.	18.2	39.	975.5	329.	2.3	-2.0	1.2
550.	18.0	39.	970.4	321.	3.3	-2.5	2.1
600.	17.9	39.	965.2	315.	2.3	-1.6	1.6
650.	17.7	39.	960.1	298.	2.0	-0.9	1.8
700.	17.5	40.	955.4	325.	3.0	-2.5	1.7
750.	17.0	41.	951.1	314.	2.4	-1.7	1.7
800.	16.7	41.	946.7	317.	2.9	-2.1	2.0
850.	16.5	41.	941.9	316.	2.5	-1.8	1.7
900.	16.2	41.	937.4	331.	1.8	-1.6	0.9
950.	15.8	40.	933.2	348.	1.9	-1.8	0.4

ESTIMATED HEIGHT OF MIXING DEPTH: 201 METERS

NOTES: M3=CUBIC METER, C=DEGREES CELSIUS, G=GRAMS,
HEIGHT=GEOPOTENTIAL HEIGHT, AGL=ABOVE GROUND LEVEL
M=MISSING

METEOROLOGICAL DATA ALOFT — DATE: 25 SEP 1996

TEST PROGRAM: DNA — TIME: 0100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	27.0	5.3	---	---
100.	25.2	8.1	-7.3	-3.5
200.	23.7	8.2	-7.5	-3.3
300.	20.1	8.1	-7.6	-2.8
400.	15.0	7.6	-7.3	-2.0
500.	7.9	6.9	-6.9	-1.0
600.	358.9	6.1	-6.1	0.1
700.	351.4	5.4	-5.3	0.8
800.	345.9	4.8	-4.6	1.2
900.	322.7	3.0	-2.3	1.8
1000.	280.2	2.4	-0.4	2.4
1100.	253.0	3.6	1.1	3.5
1200.	245.7	4.8	2.0	4.4
1300.	249.0	5.2	1.9	4.8
1400.	251.7	5.5	1.7	5.2
1500.	254.1	5.7	1.6	5.5
1600.	259.1	5.8	1.1	5.7
1700.	265.2	5.9	0.5	5.9
1800.	267.2	5.9	0.3	5.9

ESTIMATED HEIGHT OF MIXING DEPTH: 212 METERS

METEOROLOGICAL DATA ALOFT DATE: 25 SEP 1996

TEST PROGRAM: DNA TIME: 0200 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS
0.	322.0	2.5	---	---	
100.	342.5	6.8	-6.5	2.0	
200.	348.7	6.5	-6.4	1.3	
300.	359.4	6.0	-6.0	0.1	
400.	7.6	5.9	-5.8	-0.8	
500.	11.3	6.0	-5.9	-1.2	
600.	5.6	6.0	-6.0	-0.6	
700.	354.8	6.4	-6.4	0.6	
800.	343.5	6.4	-6.2	1.8	
900.	333.3	6.5	-5.8	2.9	
1000.	328.1	6.5	-5.5	3.4	
1100.	327.5	6.4	-5.4	3.5	
1200.	327.6	6.3	-5.3	3.4	
1300.	326.1	5.7	-4.8	3.2	
1400.	320.4	5.0	-3.9	3.2	
1500.	307.9	4.2	-2.6	3.3	
1600.	295.3	4.1	-1.7	3.7	
1700.	284.8	4.3	-1.1	4.2	
1800.	283.4	4.5	-1.0	4.4	

METEOROLOGICAL DATA ALOFT DATE: 25 SEP 1996

TEST PROGRAM: DNA TIME: 1725 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	---	---	---	---
100.	18.6	7.8	-7.4	-2.5
200.	15.3	7.7	-7.5	-2.0
300.	9.9	7.4	-7.3	-1.3
400.	2.3	7.0	-7.0	-0.3
500.	351.7	6.7	-6.6	1.0
600.	344.2	6.8	-6.5	1.9
700.	337.6	7.2	-6.6	2.7
800.	333.2	7.4	-6.6	3.3
900.	327.5	6.8	-5.8	3.7
1000.	318.8	6.3	-4.8	4.2
1100.	306.9	6.5	-3.9	5.2
1200.	298.1	7.3	-3.4	6.4
1300.	293.3	8.8	-3.5	8.1
1400.	290.9	10.2	-3.6	9.5
1500.	289.9	11.5	-3.9	10.8
1600.	288.5	12.3	-3.9	11.6
1700.	286.9	12.9	-3.7	12.3
1800.	286.2	12.9	-3.6	12.4

ESTIMATED HEIGHT OF MIXING DEPTH: 315 METERS

METEOROLOGICAL DATA ALOFT — DATE: 25 SEP 1996

TEST PROGRAM: DNA — TIME: 1900 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	8.0	8.6	---	---
100.	16.8	7.4	-7.1	-2.2
200.	14.7	6.7	-6.5	-1.7
300.	10.9	5.2	-5.1	-1.0
400.	4.7	4.2	-4.2	-0.3
500.	353.0	4.2	-4.2	0.5
600.	342.3	4.9	-4.7	1.5
700.	334.1	6.3	-5.6	2.7
800.	322.2	6.9	-5.5	4.2
900.	310.5	7.6	-5.0	5.8
1000.	298.7	7.7	-3.7	6.8
1100.	289.1	8.0	-2.6	7.5
1200.	285.3	8.4	-2.2	8.1
1300.	285.5	9.2	-2.4	8.9
1400.	285.7	9.9	-2.7	9.5
1500.	285.9	10.6	-2.9	10.2
1600.	286.6	11.3	-3.2	10.8
1700.	287.4	11.9	-3.6	11.4
1800.	288.0	12.2	-3.8	11.6

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT DATE: 25 SEP 1996

TEST PROGRAM: DNA TIME: 2000 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	19.0	7.4	---	---
100.	16.3	7.5	-7.2	-2.1
200.	17.2	7.0	-6.7	-2.1
300.	14.8	6.3	-6.1	-1.6
400.	10.4	5.5	-5.4	-1.0
500.	0.5	5.2	-5.2	0.0
600.	347.8	5.3	-5.2	1.1
700.	338.0	5.6	-5.2	2.1
800.	329.7	6.1	-5.3	3.1
900.	317.6	6.9	-5.1	4.6
1000.	310.8	7.7	-5.0	5.8
1100.	306.9	8.2	-4.9	6.6

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT — DATE: 25 SEP 1996

TEST PROGRAM: DNA — TIME: 2100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	16.0	7.1	---	---
100.	359.3	6.0	-6.0	0.1
200.	359.6	6.3	-6.3	0.0
300.	358.4	6.6	-6.6	0.2
400.	355.5	6.6	-6.6	0.5
500.	352.3	6.2	-6.1	0.8
600.	346.4	5.4	-5.3	1.3
700.	340.1	5.1	-4.8	1.8
800.	333.5	5.3	-4.8	2.4
900.	325.5	6.5	-5.3	3.7
1000.	321.2	7.9	-6.2	5.0
1100.	316.0	9.6	-6.9	6.6
1200.	311.0	10.8	-7.1	8.1
1300.	305.4	12.2	-7.1	9.9
1400.	300.7	13.5	-6.9	11.6
1500.	296.6	14.8	-6.6	13.2
1600.	292.6	15.2	-5.8	14.0
1700.	288.4	15.1	-4.8	14.4
1800.	286.6	14.9	-4.3	14.2

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

METEOROLOGICAL DATA ALOFT DATE: 25 SEP 1996

TEST PROGRAM: DNA TIME: 2200 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 513 METERS
0.	19.0	5.2	---	---	
100.	14.5	5.8	-5.6	-1.5	
200.	10.0	5.9	-5.8	-1.0	
300.	4.8	5.9	-5.9	-0.5	
400.	356.9	5.6	-5.6	0.3	
500.	352.7	5.6	-5.5	0.7	
600.	349.1	5.9	-5.8	1.1	
700.	343.0	6.6	-6.3	1.9	
800.	337.3	7.5	-6.9	2.9	
900.	331.3	8.3	-7.3	4.0	
1000.	325.5	8.8	-7.2	5.0	
1100.	319.8	9.3	-7.1	6.0	
1200.	315.3	9.9	-7.0	6.9	
1300.	311.1	10.7	-7.0	8.1	
1400.	307.5	11.7	-7.1	9.3	
1500.	304.7	12.9	-7.3	10.6	
1600.	301.6	14.1	-7.4	12.0	
1700.	298.8	15.4	-7.4	13.5	
1800.	297.5	15.7	-7.3	13.9	

METEOROLOGICAL DATA ALOFT DATE: 25 SEP 1996

TEST PROGRAM: DNA TIME: 2300 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	25.0	3.8	---	---
100.	1.9	3.5	-3.5	-0.1
200.	4.7	3.4	-3.4	-0.3
300.	10.6	3.4	-3.3	-0.6
400.	19.1	3.2	-3.1	-1.1
500.	25.6	3.3	-3.0	-1.4
600.	29.3	3.4	-2.9	-1.7
700.	27.8	3.3	-2.9	-1.5
800.	14.1	3.2	-3.1	-0.8
900.	347.2	4.2	-4.1	0.9
1000.	332.4	5.6	-4.9	2.6
1100.	324.1	7.2	-5.8	4.2
1200.	319.8	8.5	-6.5	5.5
1300.	316.0	9.7	-7.0	6.7
1400.	312.7	11.0	-7.4	8.1
1500.	309.8	12.4	-7.9	9.5
1600.	306.5	13.7	-8.1	11.0
1700.	303.3	14.9	-8.2	12.5
1800.	302.0	15.4	-8.2	13.1

ESTIMATED HEIGHT OF MIXING DEPTH: 801 METERS

METEOROLOGICAL DATA ALOFT — DATE: 25 SEP 1996

TEST PROGRAM: DNA — TIME: 2359 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	30.0	5.7	---	---
100.	21.0	6.7	-6.3	-2.4
200.	19.7	6.7	-6.3	-2.3
300.	18.9	6.6	-6.2	-2.1
400.	18.2	6.2	-5.9	-1.9
500.	17.4	5.5	-5.2	-1.6
600.	15.9	4.6	-4.4	-1.3
700.	12.5	4.2	-4.1	-0.9
800.	4.8	3.7	-3.6	-0.3
900.	351.2	4.0	-3.9	0.6
1000.	342.7	4.5	-4.3	1.3
1100.	333.4	5.6	-5.0	2.5
1200.	329.2	6.8	-5.8	3.5
1300.	324.7	8.0	-6.5	4.6
1400.	320.3	9.0	-6.9	5.7
1500.	315.5	9.7	-6.9	6.8
1600.	310.8	10.6	-6.9	8.0
1700.	306.5	11.5	-6.9	9.3
1800.	305.0	12.0	-6.9	9.8

ESTIMATED HEIGHT OF MIXING DEPTH: 894 METERS

METEOROLOGICAL DATA ALOFT — DATE: 26 SEP 1996

TEST PROGRAM: DNA — TIME: 0100 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	7.0	3.4	---	---
100.	16.2	3.9	-3.8	-1.1
200.	17.9	4.0	-3.8	-1.2
300.	20.0	4.0	-3.8	-1.4
400.	21.5	4.1	-3.8	-1.5
500.	25.5	4.3	-3.9	-1.9
600.	27.1	4.5	-4.0	-2.0
700.	28.3	4.6	-4.0	-2.2
800.	28.7	4.5	-3.9	-2.2
900.	22.1	4.3	-4.0	-1.6
1000.	15.5	4.2	-4.0	-1.1
1100.	2.4	4.3	-4.3	-0.2
1200.	351.3	4.7	-4.7	0.7
1300.	341.9	5.5	-5.3	1.7
1400.	333.7	6.6	-5.9	2.9
1500.	327.0	8.0	-6.7	4.4
1600.	319.3	9.5	-7.2	6.2
1700.	312.8	11.2	-7.6	8.3
1800.	310.4	11.9	-7.7	9.0

ESTIMATED HEIGHT OF MIXING DEPTH: 801 METERS

METEOROLOGICAL DATA ALOFT DATE: 26 SEP 1996

TEST PROGRAM: DNA TIME: 0220 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 216 METERS
0.	326.0	1.2	---	---	
100.	6.8	5.8	-5.7	-0.7	
200.	6.9	5.6	-5.6	-0.7	
300.	9.2	6.1	-6.0	-1.0	
400.	8.6	5.9	-5.8	-0.9	
500.	8.9	5.8	-5.7	-0.9	
600.	7.6	6.0	-6.0	-0.8	
700.	5.5	6.0	-5.9	-0.6	
800.	6.1	6.3	-6.2	-0.7	
900.	7.0	6.7	-6.7	-0.8	
1000.	8.1	6.9	-6.8	-1.0	
1100.	6.8	6.9	-6.9	-0.8	
1200.	4.3	6.8	-6.8	-0.5	
1300.	358.0	6.3	-6.3	0.2	
1400.	348.9	6.0	-5.9	1.2	
1500.	337.6	6.1	-5.6	2.3	
1600.	328.1	7.4	-6.3	3.9	
1700.	322.4	9.4	-7.4	5.7	
1800.	321.0	10.5	-8.1	6.6	

METEOROLOGICAL DATA ALOFT — DATE: 26 SEP 1996

TEST PROGRAM: DNA — TIME: 1715 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	330.0	5.8	---	---
100.	341.9	3.6	-3.4	1.1
200.	343.1	3.8	-3.7	1.1
300.	343.7	3.9	-3.7	1.1
400.	342.5	3.9	-3.7	1.2
500.	342.0	3.9	-3.7	1.2
600.	339.8	4.0	-3.8	1.4
700.	338.6	5.1	-4.7	1.8
800.	336.5	6.3	-5.7	2.5
900.	331.7	7.6	-6.7	3.6
1000.	327.8	8.5	-7.2	4.5
1100.	324.1	9.3	-7.5	5.4
1200.	322.5	10.1	-8.0	6.2
1300.	323.0	11.2	-9.0	6.7
1400.	324.7	11.7	-9.5	6.7
1500.	327.6	11.4	-9.7	6.1
1600.	330.7	10.7	-9.3	5.2
1700.	334.2	9.8	-8.8	4.3
1800.	334.8	9.6	-8.7	4.1

ESTIMATED HEIGHT OF MIXING DEPTH: 1530 METERS

METEOROLOGICAL DATA ALOFT DATE: 26 SEP 1996

TEST PROGRAM: DNA TIME: 1800 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1350 METERS
0.	345.0	6.3	---	---	
100.	345.1	6.8	-6.5	1.7	
200.	343.5	6.9	-6.6	2.0	
300.	340.6	7.0	-6.6	2.3	
400.	338.2	7.2	-6.7	2.7	
500.	335.7	7.1	-6.4	2.9	
600.	334.1	7.3	-6.5	3.2	
700.	333.5	7.9	-7.1	3.5	
800.	330.1	7.6	-6.6	3.8	
900.	325.9	7.7	-6.4	4.3	
1000.	322.6	7.7	-6.1	4.7	
1100.	321.4	7.6	-6.0	4.8	
1200.	321.5	7.6	-6.0	4.7	
1300.	322.0	7.4	-5.8	4.6	

METEOROLOGICAL DATA ALOFT — DATE: 26 SEP 1996

TEST PROGRAM: DNA — TIME: 2000 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: > 1170 METERS
0.	349.0	9.8	---	---	
100.	4.3	5.5	-5.5	-0.4	
200.	3.8	5.1	-5.1	-0.3	
300.	4.0	4.6	-4.6	-0.3	
400.	359.0	4.8	-4.8	0.1	
500.	351.4	5.8	-5.7	0.9	
600.	344.5	7.1	-6.8	1.9	
700.	338.9	7.5	-7.0	2.7	
800.	333.8	8.3	-7.5	3.7	
900.	327.6	8.9	-7.5	4.8	
1000.	323.6	9.3	-7.4	5.5	
1100.	321.2	9.9	-7.7	6.2	

METEOROLOGICAL DATA ALOFT DATE: 26 SEP 1996

TEST PROGRAM: DNA TIME: 2100 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	17.0	7.6	---	---
100.	22.3	4.1	-3.8	-1.5
200.	17.9	4.4	-4.2	-1.3
300.	13.5	4.3	-4.2	-1.0
400.	8.3	4.4	-4.4	-0.6
500.	2.4	4.7	-4.7	-0.2
600.	355.0	4.8	-4.7	0.4
700.	344.4	5.1	-4.9	1.4
800.	333.4	6.1	-5.5	2.7
900.	325.6	7.6	-6.3	4.3
1000.	322.2	8.9	-7.0	5.4
1100.	323.1	10.1	-8.1	6.1
1200.	325.2	10.7	-8.8	6.1
1300.	328.8	11.2	-9.6	5.8
1400.	330.9	11.9	-10.4	5.8
1500.	331.7	12.8	-11.3	6.1
1600.	330.2	13.6	-11.8	6.8
1700.	327.9	14.4	-12.2	7.7
1800.	326.9	14.6	-12.2	8.0

ESTIMATED HEIGHT OF MIXING DEPTH: 801 METERS

METEOROLOGICAL DATA ALOFT — DATE: 26 SEP 1996

TEST PROGRAM: DNA — TIME: 2200 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	0.0	0.0	0.0	0.0
100.	15.1	7.7	-7.4	-2.0
200.	15.9	8.4	-8.1	-2.3
300.	15.5	9.0	-8.7	-2.4
400.	17.5	9.2	-8.8	-2.8
500.	17.0	8.3	-8.0	-2.4
600.	13.8	6.5	-6.3	-1.5
700.	5.8	4.4	-4.4	-0.5
800.	351.9	4.8	-4.7	0.7
900.	341.8	5.6	-5.3	1.7
1000.	336.5	6.9	-6.4	2.8
1100.	331.2	8.5	-7.5	4.1
1200.	325.6	9.4	-7.7	5.3
1300.	320.9	10.2	-7.9	6.4
1400.	318.2	10.7	-8.0	7.1
1500.	316.1	10.9	-7.9	7.6

ESTIMATED HEIGHT OF MIXING DEPTH: 801 METERS

METEOROLOGICAL DATA ALOFT DATE: 26 SEP 1996

TEST PROGRAM: DNA TIME: 2300 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 706 METERS
0.	344.0	6.5	---	---	
100.	13.5	4.2	-4.1	-1.0	
200.	11.4	4.2	-4.1	-0.8	
300.	9.5	4.2	-4.2	-0.7	
400.	7.0	4.6	-4.6	-0.6	
500.	5.2	4.9	-4.8	-0.4	
600.	1.1	5.0	-5.0	-0.1	
700.	354.4	4.9	-4.9	0.5	
800.	345.4	5.2	-5.0	1.3	
900.	333.3	6.1	-5.5	2.7	
1000.	326.8	7.2	-6.1	4.0	
1100.	320.4	8.7	-6.7	5.5	
1200.	316.6	9.7	-7.0	6.7	
1300.	314.8	10.5	-7.4	7.4	
1400.	315.2	11.0	-7.8	7.7	
1500.	317.5	11.1	-8.2	7.5	
1600.	318.9	11.1	-8.4	7.3	
1700.	321.0	10.9	-8.5	6.9	

METEOROLOGICAL DATA ALOFT — DATE: 27 SEP 1996

TEST PROGRAM: DNA — TIME: 0030 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	10.0	3.4	---	---
100.	8.1	4.1	-4.0	-0.6
200.	8.2	4.2	-4.2	-0.6
300.	9.3	4.7	-4.6	-0.8
400.	10.2	5.0	-4.9	-0.9
500.	10.1	5.4	-5.3	-0.9
600.	10.0	5.7	-5.6	-1.0
700.	7.5	6.1	-6.1	-0.8
800.	6.0	6.5	-6.5	-0.7
900.	2.2	7.1	-7.1	-0.3
1000.	358.9	7.7	-7.7	0.1
1100.	355.2	8.4	-8.3	0.7
1200.	351.6	8.9	-8.8	1.3
1300.	347.8	9.2	-9.0	2.0
1400.	343.3	9.4	-9.0	2.7
1500.	338.1	9.4	-8.7	3.5
1600.	333.0	9.5	-8.4	4.3
1700.	328.2	9.6	-8.2	5.1
1800.	326.8	9.7	-8.1	5.3

ESTIMATED HEIGHT OF MIXING DEPTH: 1530 METERS

METEOROLOGICAL DATA ALOFT DATE: 27 SEP 1996

TEST PROGRAM: DNA TIME: 0120 (UTC)

LOCATION: PAD 11 AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)	ESTIMATED HEIGHT OF MIXING DEPTH: 990 METERS
0.	12.0	3.7	---	---	
100.	4.2	4.8	-4.8	-0.4	
200.	4.6	5.5	-5.5	-0.4	
300.	5.5	6.5	-6.5	-0.6	
400.	6.4	7.1	-7.1	-0.8	
500.	8.3	7.4	-7.4	-1.1	
600.	10.2	7.5	-7.4	-1.3	
700.	11.9	7.6	-7.5	-1.6	
800.	13.4	7.9	-7.7	-1.8	
900.	13.0	8.2	-8.0	-1.8	
1000.	12.5	8.1	-7.9	-1.7	
1100.	9.8	7.6	-7.5	-1.3	
1200.	5.9	7.3	-7.2	-0.7	
1300.	0.9	7.3	-7.3	-0.1	
1400.	357.9	7.4	-7.4	0.3	
1500.	355.9	7.7	-7.7	0.5	

METEOROLOGICAL DATA ALOFT — DATE: 27 SEP 1996

TEST PROGRAM: DNA — TIME: 0300 (UTC)

LOCATION: PAD 11 — AZIMUTH OF FIRE: 360.0 (DEG)

HEIGHT (M)	WIND DIR (DEG)	WIND SPEED (M/SEC)	RANGE WIND (M/SEC)	CROSS WIND (M/SEC)
0.	3.0	5.0	---	---
100.	17.0	7.7	-7.4	-2.2
200.	17.5	8.2	-7.8	-2.5
300.	15.5	8.5	-8.2	-2.3
400.	13.5	8.8	-8.6	-2.1
500.	7.5	11.0	-10.9	-1.4
600.	0.8	10.8	-10.8	-0.1
700.	351.1	9.2	-9.1	1.4
800.	344.2	9.2	-8.9	2.5

ESTIMATED HEIGHT OF MIXING DEPTH: 414 METERS

APPENDIX B. REFERENCES

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APPENDIX C. DISTRIBUTION LIST

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